THE

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	Page
Electric Signalling in Mines	65
Rubber	66
The Telephone Service	67
Light from Power	67
Legal	67
Cracked and Seized Pistons on Diesel Engines (*illus.*)	70
War Items	72
Correspondence—	
Pocket Dry Batteries	73
Gas *v.* Electricity	73
Business Notes	73
A Low-Priced Electric Vehicle (*illus.*)	79
The Central Power Station of the Randfontein Estates, by R. Turnbull Mawdesley (*illus.*)	80
Notes	83
City Notes	86
Stocks and Shares	89
Electric Tramway and Railway Traffic Returns	90
Share List of Electrical Companies	90
New Russian Customs Tariff (*concluded*)...	91
An Investigation of Dielectric Losses with the Cathode-Ray Tube, by John P. Minton (*illus.*)	91
Societies and Institutions	93
Units from Refuse, by A. J. Abraham	94
New Patents Applied for, 1915	96
Abstracts of Published Specifications	96
Contractors' Column ... ... Advertisement page xviii	

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ELECTRIC SIGNALLING IN MINES.

THE report of the investigations made by Dr. R. V. Wheeler into battery bell signalling systems and their dangers, which we recently reproduced in abstract, amply supports his original conclusions regarding the risks attending the unregulated use of electric bell signals.

The series of experiments on the influence of pressure, current and self-induction on the igniting power provides some interesting results. Unfortunately, Dr. Wheeler contented himself with merely tabulating and plotting the results of his experiments. He has failed to notice that his curves follow a simple law which has a physical significance, and which gives order and coherency to an otherwise unintelligible and apparently disconnected series of results. Plotting igniting current in amperes against self-induction in henries, a series of curves is obtained. Now, it has been remarked by Prof. Thornton that similar curves obtained by him are curves of approximately equal energy —"iso-energetics" we may call them. The curves given in Dr. Wheeler's report actually follow a law of the form $Li^{1.54} =$ a constant. The value of the constant depends on the percentage of methane, but does not appear to be any simple function of this percentage content, though it diminishes steadily as the mixture becomes more sensitive.

Hence we may say that the igniting power of a break-flash depends upon the $Li^{1.54}$ of the circuit, or, approximately, the Li^3. There is, of course, much *a priori* reason to expect that the igniting power of a spark should be proportional to the energy of self-induction liberated, and although these experiments do not quite give an igniting power proportional to $\frac{1}{2} Li^2$, yet they distinctly suggest that it is rather to the *energy* stored in the circuit than to the current or voltage, or even the self-inductance, that we must look to obtain the igniting power of a break-flash. In this connection it is curious to note that Dr. Wheeler's results for 6 per cent. methane may be represented by the formula $(L - 0{\cdot}0065)\, i^2 = 0{\cdot}0141$, almost as accurately as by $Li^{1.54} = 0{\cdot}0219$—a fact which would suggest an igniting power proportional to the energy, but with an unrecorded capacity in the circuit. No such formula can be found for the other series of values, which follow the Li^3 law very consistently.

The conclusions drawn from these experiments may thus be re-stated simply as follows:—For every gaseous mixture there is a constant value of the product Li^3 beyond which the break-flash will be capable of igniting the mixture. This is certainly more scientific, and appears to us to be far more easily handled than the cumbrous circumlocution of the summary in the report.

The experiments with bells were conducted with a view to reducing the two factors which had been discovered in the preceding experiments to affect the igniting power of the spark, viz., self-induction and current strength. A large number of bells were examined, and all were found to

be capable of giving a dangerous break-flash when used with a battery of 10 wet Leclanché cells (15 volts). Still more dangerous were the break-flashes obtained by using dry cells, owing to the smaller internal resistance and consequently larger value of the current. In the majority of cases, however, sufficient non-inductive resistance could be introduced into the circuit to reduce the current available at the break-flash below the minimum igniting current without seriously affecting the ringing power of the bell. Why Dr. Wheeler suggests a winding of brass wire of the same section as the original copper wire, instead of an equally suitable smaller size of copper wire, is to us a mystery.

In order to reduce the effects of self-induction, various methods were tested, including the use of two windings on the bobbins, of which only one is used as the "exciting winding" for the magnet, the other being short-circuited on itself. The principle upon which this method of winding acts is that when the current passing through the exciting winding is broken, it induces a current in the short-circuited winding which absorbs the energy stored by the self-induction of the exciting winding, so that the intensity of the break-flash is greatly reduced.

A similar effect is produced by interposing strips of tinfoil between the successive layers of the winding; in the mass of metal thus introduced eddy currents are set up which absorb the energy of self-induction, which would otherwise be expended at the break-flash.

It is remarkable that the method, well-known to electrical engineers, of shunting the coils with a high resistance, to which Mr. H. R. Kempe drew attention in our "Correspondence" columns, the most obvious method of absorbing the energy of self-induction, should not have been investigated. In fact, the investigations seem to have suffered throughout from the overlooking of the fact that it is the *energy* of the circuit that has to be dealt with, and not the current and self-induction separately. The condenser-shunt method of reducing the sparking energy has been tried by Mr. T. G. Watts (see abstract of paper in ELECTRICAL REVIEW of January 1st, 1915), who found that with an ordinary rubbing contact "the introduction of a condenser across the knocking-wires had some peculiar physical influence on the spark," and he adds: "One can only conclude it to be a matter of temperature." Such a remark as this shows very clearly that the function of the condenser was totally misunderstood, and that the experiments were conducted on the "hit or miss" plan rather than on sound scientific principles.

However, Mr. Watts discovered that although putting a condenser across the bell spark gap converted an otherwise unsafe bell into a safe one, and that with rubbing contacts equal safety was obtained in the line wires, yet when the usual method of shorting the wires by means of a file or knife was resorted to, the condenser system proved to be useless.

Another method of reducing the igniting power of the break-flash, which has been found successful by Mr. Watts, is that of the introduction of relays. A relay may, of course, be actuated by a very small current, and the sparking at the contacts will in this case be mild. But Dr. Wheeler adopts the remarkable attitude towards relays indicated by these lines, quoted from the last paragraph of his report:—"All the considerations advanced in this report respecting bells apply, probably with equal force, to relays. *A relay*, if introduced into the signalling system, *simply takes the place of the bell, and from the point of view of danger at the break-flash on the signal wires, can be regarded as a bell.*" Such a confession of want of knowledge of the function of relays would be amusing, were it not for the fact that on such investigations as these depend the regulations governing safety in mines. The chemical portions of this report are no doubt of the utmost value, but its many shortcomings on the physical side only serve to emphasise the inadvisability of entrusting electrical investigations of such vital importance to chemical experts.

Dr. Wheeler is a distinguished chemist, with a certain amount of electrical knowledge, such as every competent chemist must possess nowadays; but he is clearly not an electrical expert, for a perusal of his report shows plainly that a large proportion of his experiments were conducted over ground which was already familiar to electrical men, and some of his "conclusions" could have been written down by an electrical engineer without recourse to experiments, whilst others would not have been included at all.

Rubber.

THERE has been quite a cheerful tone in the rubber market lately, and under the influence of decidedly good buying, a considerable proportion of which is attributed to the United States, prices have moved upwards to an appreciable extent, and the market looks good at round the current enhanced values, which have been established in the neighbourhood of 2s. 7½d. for early delivery of the usual standard grade of plantation material. There is no mistaking the activity of consumption in all directions, the destructive use of rubber in the war being one of the most striking features of the industrial situation. There is a good deal of truth in the assertions which have been made that the war will ultimately be settled by the Powers having the best supplies of rubber and motor spirit, and if these really prove to be the ultimate factor, there can be not the slightest question as to the triumphant progress ultimately of the forces of the Entente Powers over the disturbers of peace of Central Europe. Not only have manufacturers in all directions been busy laying in supplies of crude rubber, but there seems to have been some sort of speculative account in the market, the instigators of which, frightened by the rising wave of buying, were forced to come in and cover, thus assisting the progress of the upward movement. War requirements are absorbing enormous quantities of material, and all indications point to a still further burst of buying as the war nears the more critical stages. The American trade is benefiting enormously from orders for Britain, France and Russia for tires, and in all parts of the country plants are engaged at the utmost capacity of production. One order recently placed with an Ohio factory was for half a million dollars' worth of solid rubber tires on behalf of one of the Allied Governments, this coming on top of an order for a similar value, while inquiries for still larger quantities than ever hitherto placed are now being dealt with.

As regards fine hard Para descriptions, these are being rather lost sight of in view of the growing popularity of the plantation product, and business is reported to be quiet in all connections, but in sympathy, of course, with the firmer aspect of the market, for the latter prices have undergone a moderate hardening process. The statistical position taken generally may be regarded as quite satisfactory, and latterly there has been an encroachment upon the home stocks which last month fell to about 8,250 tons, a total which compares with 5,700 tons last year, and 6,500 tons in 1913.

Official advices received from Kuala Lumpur announce that the export of plantation rubber from the Federated Malay States during the month of June amounted to 3,403 tons as compared with 2,708 tons in May last and 2,306 tons in the corresponding month last year.

The following is a comparative table showing the export for three years:—

	1913.	1914.	1915.	
January... ...	2,131	2,542	3,473	tons.
February ...	1,757	2,364	3,411	,,
March	1,737	2,418	3,418	,,
April	1,626	2,151	2,777	,,
May	1,225	2,069	2,708	,,
June	2,005	2,306	3,403	,,
Total ...	10,481	13,850	19,190	,,

The Telephone Service.

AN editorial in the *Telegraph and Telephone Journal* for July takes us to task for our comments on the conduct of the London telephone service; the article is somewhat belated, as our remarks were published on May 21st, but we feel bound to take exception to some of the points which are raised in it.

The difficulties alleged to be "created by the Board of the late National Telephone Co. in its later years, with regard to the development of the telephone service after 1911," ought rather to be attributed to the policy adopted towards the company by the State; we may remind our contemporary of the French saying, which we paraphrase: That is a wicked company; if you attack it, it defends itself! "We have no wish to urge that the Telephone Service in London is perfect," says our contemporary, with commendable restraint; and it candidly admits that the erratic disposition of the connections between subscribers and exchanges in London arose out of the competition between the Post Office and the Telephone Co.—a competition which, in our opinion, was ill-advised and contrary to the public interest.

The *Journal* digresses to point out that a change of number would have been essential if we had installed a private branch exchange; this is wholly beside the question, but if the case had arisen it would have been due to our own initiative, and we should have had no ground for complaint. What we objected to was a change of a long-established number at the initiative, and to suit the convenience, of the Post Office, regardless of our wishes.

As for the concluding reference to our "suggestion that the present change was made as a reprisal because of past warnings and criticisms of the Telephone Service" in our columns, we emphatically repudiate the "suggestion," which emanates solely from our contemporary. We never looked upon the matter in that light, and we fail to see how our comments can be distorted to produce such an impression.

Light from Power.

THE report of a case recently decided before a Scottish Court, which we publish herewith, will be read with keen interest by supply authorities. It is, we believe, the first instance in which the question, often raised, has been put to the test, namely, whether a consumer who uses a motor-generator to supply current for lighting his premises can lawfully claim to be charged for energy at the power rate.

On several occasions our Legal Contributor has dealt with the matter, his opinion being that as the energy is used for lighting purposes, the lighting tariff applies, and this view, of course, is endorsed by every station manager. As a matter of equity, we have no doubt that this is the correct view to take, the interposition of the motor-generator being merely a mechanical quibble; the rotary machine, in fact, is in effect precisely equivalent to a stationary A.C. transformer, and no one would seriously maintain that energy used for lighting through the intermediary of a transformer could be regarded as energy for motive power. The Scottish magistrate appears to have been influenced by the fact that the current used for lighting in the case under consideration was generated quite separately from the current used to drive the motor, losing sight of the fact, obvious to an electrical engineer, that the commodity supplied and charged for was not *current*, but *energy*, which flowed in a continuous and unbroken stream from the supply mains to the lamps. We feel sure that if the case could be re-tried, and if this aspect of the matter were properly presented to the Court, the decision would be reversed.

The point is explicitly covered in the London Electric Supply Act, 1908, Sec. 7, which states that "the expression 'power purposes' shall include all purposes to which electrical energy may be applied other than for use *either directly or indirectly* for lighting," and a penalty is prescribed for the use for lighting of a supply given for power purposes under this section. A clause in Sec. 18 of the Electric Lighting Act of 1882 forbids undertakers "in any way to control or interfere with the manner in which electricity supplied by them . . . . . is used." How this clause would be interpreted by the Courts in this connection we cannot say; it has never been put to the test.

LEGAL.

ADAMS & MCLEAN *v.* ADNIL ELECTRIC CO., LTD.

IN the City of London Court, on July 9th, before his Honour Judge Rentoul, K.C., Archibald C. Adams and Alexander McLean (trading as Robertson & Adams), Glasgow, sued the Adnil Electric Co., Ltd., for £7 2s. 11d., for an allowance as specified in a written agreement in April, and for electric lamps supplied.

MR. SOLOMON, defendants' solicitor, said the action ought never to have been brought. The claim was brought under a contract by which the plaintiffs were to act as agents for the defendants in Glasgow, and one clause of the contract specified that in the event of a dispute arising the matter should be referred to arbitration. As a matter of fact, both the parties had appointed their arbitrators, and therefore he asked that the action should be dismissed.

MR. ADAMS, one of the plaintiffs, said they had submitted other matters to arbitration, but that had nothing to do with the dispute before the Court, if it could be called a dispute. In his view there was no dispute, because the plaintiffs were employed to act as agents for the defendants, at a salary of £100 a year. That salary was payable monthly, and it was for one of those monthly payments that the present action was brought. The plaintiffs were electrical engineers, and he could not understand why the defendants were refusing to pay.

JUDGE RENTOUL said it was pretty plain according to the agreement that if a dispute arose it was to be referred to arbitration.

MR. SOLOMON said his case was that the contract was terminated by the end of March by verbal arrangement.

MR. ADAMS said that the plaintiffs had been carrying out the defendants' commands as late as last month. They could not be out of the defendants' employment if that were the case.

JUDGE RENTOUL did not think that the failing to pay wages was a dispute, but arbitration would be a much more satisfactory tribunal than that Court. He would send the case to arbitration and remit the costs. Plaintiffs should have had a lawyer.

MR. ADAMS: Good gracious! The lawyers would have laughed at me.

The JUDGE said the action would be dismissed.

MR. ADAMS urged that as the agreement was for four years defendants must pay his salary. A dispute must be a contention, and there must be an agreement. He knew of none.

MR. SOLOMON added that plaintiffs discontinued acting for the defendants in March. It was mutually arranged in December that it should be so. The agreement stated that if the plaintiffs did not do £4,000 worth of business in electrical goods the agreement would lapse at the end of any one of the four years. Owing to the war, the receipts last year were £1,390, and when plaintiffs and defendants met in December the agreement was annulled, so that the plaintiffs could get other agencies. Defendants thought they were meeting the plaintiffs by giving them that opportunity.

The case was sent to arbitration.

THE BURGH OF ALLOA *v.* ALLOA THEATRE CO., LTD.

IN Alloa Sheriff Court, on Wednesday last week, SHERIFF-SUBSTITUTE J. DEAN LESLIE heard expert evidence in the action at the instance of the Provost, Magistrates and Councillors of the Burgh of Alloa against the Alloa Theatre Co., Ltd., trading at the Pavilion, Alloa, for payment of an account for a supply of electricity during the month of March.

Mr. Charles Thomson, town clerk, appeared for the pursuers, and Mr. John Reed, solicitor, for the defenders.

The first hearing of the case was reported in our issue of June 25th, page 885; it was agreed that an expert witness should be heard on either side.

MR. JAMES EDWARD SAYERS, electrical engineer, Glasgow, who appeared on behalf of the Alloa Town Council, said he had had considerable experience in supplying electrical energy for both power and lighting. He visited the property of the defenders, and inspected the arrangements in use for the electrical energy supplied by the Burgh of Alloa. The service from the street was a three-wire service. Two of the circuits were connected with the 220-volt terminals, and one was connected with the 440-volt terminals. The two 220-volt circuits were connected with the lamps for the general illumination of the building. The third circuit was connected to a pressure transformer. At one side this pressure transformer was supplied at 440 volts, and from the other side current was taken at 60 volts. On this low-pressure circuit there were connected two arc lamps, one lamp belonging to the bioscope and one being an ordinary arc lamp for illuminating the stage.

MR. THOMSON: What has been your experience in the installation of these machines?—They have always been put in for arc lamps which require 60 or 65 volts, and where the pressure of supply has been very much higher, and they have always been put on the lighting rate.

Are you aware that there are differential rates charged for lighting and power?—Yes.

On what are they based?—On a consideration of cost of production, which is governed by long-hour consumption for power and short-hour consumption for light.

What is the difference between a motor-generator and a pressure transformer?—A motor is a machine which you supply with electrical energy at one end to produce rotary motion, which is used to drive machines, shafting, or anything that requires motion. A pressure transformer is a machine into which you lead electrical

energy at a certain pressure at the one end, and at the other end electrical energy of another pressure is delivered.

Cross-examined by Mr. Reed: Suppose that instead of reducing the voltage we used this generator for the purpose of producing a new current, do you call that a transformer?—Yes.

Is the current registered by the 440-volt meter taken to the motor?—Yes.

Is it not the case that the whole of the current registered by the 440-volt meter in the case of the Pavilion is consumed by this motor?—It is.

Is it not the case that this motor is used for the purpose of driving a dynamo?—It is.

Is it not the case that it is this dynamo which produces the 60 voltage, and is not the current produced by the dynamo entirely different from the current supplied by the Corporation?—It is.

So that the theatre company's dynamo is driven by the current supplied to this motor?—Yes.

Do you mean to say that this current that passes through to the bioscope comes from the Corporation main?—No.

What becomes of the current supplied by the Corporation?—It is used in the motor.

And the current used in our bioscope has nothing to do with the Corporation current?—You cannot get it without the Corporation current.

If we put down a gas engine to drive the dynamo, could we not get electric current?—Yes.

Then the Corporation current is in no sense necessary to produce the current used in the bioscope?—No.

Is it because of the use of what is produced for the bioscope that you say it is light?—Yes.

We use the Corporation current in the same way as any other person getting it for power purposes?—Yes, up to the end of the motor.

And then the Corporation current is all consumed by the time it comes to the end of the motor?—Yes. It is transformed into mechanical energy.

Is it your suggestion that if you have a dynamo driven by a steam engine you are simply altering current?—No.

Does it make any difference, if you make your own current, whether you make it by gas or electricity?—Certainly not.

Supposing we put in a gas engine, should we be using gas for power or for lighting then?—For lighting, because you are using it during lighting hours.

If we use this current for 10 hours a day?—That would be ighting.

Then time has nothing to do with it?—It supplies light at the other end.

We have two arc lamps?—Yes, one for the bioscope, and one to illuminate the stage.

Is that second lamp used for lighting the theatre in any way?—I have not seen it used, but the attendant said it was used for stage effects in the same way as limelight.

Mr. Nicol Paton, electrical engineer, Glasgow, was then examined on behalf of the defenders. He maintained that the current produced by the generator was not what the Corporation supplied. It was wholly generated on the premises by the generator, and was not simply the Corporation current altered. The current from the Corporation entered the motor and left it again, going back to the Corporation main. The current used in connection with the bioscope could be produced by gas plant driving the dynamo. None of the current passing through the 440-volt meter could be used for lighting.

Mr. Thomson, after further evidence, addressed his Lordship, stating that even although the defenders were entitled to power rate, the Corporation were entitled to make their own charges so long as they did not exceed the maximum rate laid down in the Provisional Order. The Sheriff: Could you charge at a different rate from what you advertise?—Mr. Thomson: We might. The Sheriff: Where is your authority for that?—Mr Thomson: There is nothing in the Act or Provisional Order to restrain the Corporation from charging any rate provided they don't exceed the maximum price contained in the Order, which is 8d. per unit. They have a discretionary power to make special charges as they may determine.

The Sheriff, without calling upon Mr. Reed, decided in favour of the defenders, with expenses against the Corporation. Both expert witnesses, he said, were perfectly clear in stating that the energy was supplied by the Corporation to drive the motor, and there the current stopped. He had no difficulty whatever in arriving at the conclusion that the rate that should be charged should be power rate. There was nothing to show that the circumstances of this motor were any different from any other motor. If the burgh had chosen to say that one kind of motor was to be charged at a different rate from another, that might have entered into the question. They did not advertise that, however, and therefore they must allow a universal rate.

Lundberg & Sons *v.* Western Electric Co., Ltd.

In the Chancery Division on Friday (July 9th), Mr. Justice Eve heard the motion in this action. Counsel for the plaintiffs said the action was for alleged infringement of a trade-mark. Defendants had agreed to treat the motion as the trial of the action, and would submit to a perpetual injunction in the terms of the notice of motion. They would also pay the costs, and would be allowed to dispose of a small quantity of goods in their possession which bore the infringed trade-mark.

Counsel for the defendants assented to the arrangement, and his Lordship made the usual order.

Hamilton *v.* Marconi's Wireless Telegraph Co., Ltd.

The action of Mr. John Wm. Hamilton against defendant company, with whom he formerly held an appointment as "sole agent" to recover certain commissions and royalties, came before Mr. Verey, one of the High Court Official Referees, on Monday, July 12th, having been remitted from the Court of King's Bench for inquiry as to damages on a verdict by a special jury in plaintiff's favour.

Mr. Gordon Hewart, K.C., and Mr. Eustace Hills appeared for the plaintiff, and Mr. Ernest Pollock, K.C., with Mr. Stewart Bevan, for the defendants.

Mr. Gordon Hewart, K.C., in opening the plaintiff's case, said that the plaintiff had for some years prior to 1910 had to do with wireless telegraphy in Australia and the South Pacific, and in May of that year he entered into an agreement with the defendant company, whereby he became, for certain purposes and upon certain terms, their sole agent. In 1913, as plaintiff alleged, the defendants wrongfully put an end to that agreement and wrongfully dismissed him from his position, and, accordingly, by writ issued on September 1st of that year, plaintiff commenced action against the defendant company, claiming, amongst other things, certain remuneration, damages, and an account. Ultimately, that action came on for trial before Mr. Justice Avery and a special jury, and after a trial extending over 15 days, it came to an end on March 24th of this year. The jury found entirely for the plaintiff, and awarded him certain damages. But that verdict did not dispose of the matter, because on March 24th, 1914, just about a year before the verdict, an order had been made by the Master in Chambers providing for two things. It was ordered that all matters of accounts should stand over until after the trial of the action, and that the discovery of documents required should stand over also. Those matters were not, therefore, submitted to the jury, but the taking of the account was directed. What remained to be dealt with were the questions which the verdict of the jury did not deal with, and the matter was not quite simple owing to the difficulties which the plaintiff had experienced in obtaining discovery of documents from the defendants. Notwithstanding repeated applications, even up-to-date the discovery was still incomplete. He would not dwell upon the qualifications of the plaintiff, but would at once refer the Court to the agreement made between the parties as contained in a letter dated May 11th, 1910, addressed to the plaintiff by the deputy manager of the defendant company, in which he said that the company accepted his services as sole agent for the Colonies and various places abroad. It was understood that the agency should date from May, 1910, and continue for three years, subject to determination in May, 1911, by either party. It was also stipulated that should the result of the business prove satisfactory the engagement should be for three years certain, with the option of continuing it for another three years. In consideration of the plaintiff agreeing to devote his whole time to the service of the company, he was to receive a commission of 5 per cent. on the gross value of all contracts within the area mentioned, and it was agreed, in the case of shipping contracts, that a sum of £10 per ship should be paid in addition to 5 per cent. on the amount of subsidy paid by the shipowners to the company. All payments in respect of commission were to become due as received by the company, and the £10 per ship was to be paid at the date when the contract was signed by the company. The company also agreed to pay £50 a month as a contribution towards plaintiff's expenses, and in the event of the grouping of the Pacific Radio Co. he was to be offered the position of managing director in that company. The accounts with which the Court was concerned were the accounts relating to, and arising out of, first, the 5 per cent. commission on the gross value of all sales effected, which it was alleged the company had not paid, and, secondly, in relation to the 10 per cent. per ship in respect of ship contracts, in addition to the 5 per cent. Then the plaintiff by his statement of claim said that he had conducted negotiations and had rendered services in procuring business in South Africa, and asked that an account should be taken of all sales that had taken place within that district, and for payment of 5 per cent. on the gross value of all sales in South Africa. The plaintiff was summarily dismissed by the defendants in January, 1913, and he was dismissed upon what the jury had found to be an insufficient pretext that he was doing other work. In 1912 the defendants made arrangements to join forces with the Australian Wireless Co. That was to be done by the creation of a new company to take over the business of the Australian Wireless Co. and the business of the defendant company in Australia and New Zealand. This arrangement having been made, the defendant company found occasion to dispense with the services of the plaintiff, by which he was deprived of two things, one of which was the prospect of a renewal of his agreement for a further period of three years, and of his commission. The verdict of the jury had left undecided the 5 per cent. on the gross value of sales effected, the payments on the shipping contracts of the £10 per ship, and the 5 per cent, commission on the payments by the Shipping Companies. There was also another matter connected with the business in South Africa. Council then dealt in detail with the various items of the plaintiff's claim, and added that plaintiff alleged that on or about October 23rd, 1911, it was agreed through Mr. Godfrey Isaacs, the managing director, that the plaintiff's authority should be extended so as to include South Africa, and the jury had decided that question in favour of the plaintiff. Upon the part of the case relating to the 5 per cent. on the gross sales, certain points were decided in the course of the action. First of all, the Judge determined a point as to the meaning of the term gross values. For instance, there was an item of four stations sold to the Colonial Office for Fiji, and it was decided that the gross value meant the contract

price. Another term in the contract was interpreted in the course of the action—the meaning of 5 per cent. payable on the gross value of all sales effected by the company within territory described. The question as to what was meant by effected arose in reference to certain field stations which were sold to the Commonwealth Government of Australia. The defendants said that in fact those field stations were sold to the British Government, and that therefore it could not be said that the sale was within the territory described in the agreement. The plantiff's answer to that was that although the contract was made with the British Government, it was made on behalf of the Government of Australia, and it was held by the learned Judge that it was a sale effected within the territory described in the agreement. Accordingly, as far as those sales were concerned, the question remained to be decided as to what was the amount on which the 5 per cent. was to be calculated. Then there was the question as to what was the number of those field stations—whether it was four, or, as the plaintiff alleged, eight. Other questions which might be said to be questions of principle, were left to be decided by the Referee. For example, there were questions relating to the sale of three ship equipments to the Commonwealth Government of Australia in May and July, 1910. For those equipments the gross value was £2,050, and the commission claimed upon them was £102 10s. The question which arose with regard to that matter was this. The actual contract was dated May 19th, 1910, but the contract provided that the work was to be done and the price paid at the later date (July). Before May 19th, 1910, negotiations had been carried on, and time and labour had been spent upon them; but the plaintiff submitted that in ascertaining the date at which the sale was effected within the meaning of the agreement, they must look, not at the period covered by the course of the negotiations, but at the date of the signing of the contract, which was subsequent to the agreement with the plaintiff, and that he was, therefore, entitled to the commission. The defendants replied that the real business in relation to the sale was done at a date anterior to the date of the agreement. Another question related to the installation for a certain New Zealand battleship. That ship was, in fact, built by the British Government by means of money supplied by the New Zealand Government. The ship was to have been the gift of New Zealand to this country, and it was to have been the gift of a complete ship, not one in which there remained something to be done. Our own Government had an agreement with the defendants, by which they made a fixed annual payment for wireless installation of ships. When the wireless was installed upon the New Zealand ship our Government said that it was covered by the general agreement. The fact was that the money for it was provided by the New Zealand Government, and that the money found its way to the defendant company. The plaintiff was therefore entitled to his commission upon it. A similar question arose with regard to the ships of the Australian Navy. The Australian Government had certain ships built in England under the supervision of the Admiralty. They were paid for by the Australian Government, and were not presented to the British Government, but were kept as parts of the Australian Navy for use in Australian waters. The British Government put the wireless installation upon those ships, and the question arose as to whether that transaction did not come under the general agreement with the Marconi's company. The Australian Government had paid a substantial sum, which found its way to the defendant company, and the plaintiff said he was entitled to his commission in that case also. Those were sales of which the plaintiff knew, but there were others as to which discovery was not yet complete. He next passed to the sale of two high-power stations to the British Government by the defendant company. Those high-power stations were in connection with what was intended to be an Imperial chain of wireless stations—one of them at Singapore and the other at Pretoria—and the plaintiff said that those sales were within his territory, according to the finding of the jury, and that they were effected at the time the contract of sale was made. What happened there was that the defendants undoubtedly did not receive payment for those stations under the contract made at the time, and the reason why they did not had become a matter of history. To put it generally, the defendant company repudiated their contract, but the plaintiff had performed his part. The contract was made on July 19th, 1912. Each station was to cost £60,000, and the defendants were to have 10 per cent. royalty on the gross receipts for a period of 18 years. What those royalties might be expected to be was a matter of calculation. On the whole six stations the royalties were estimated at something between £4,000 and £30,000 a year. Even if the smaller figure were taken, and assuming that the two stations would be no more than the average, each giving a sixth of the whole, they might be expected to yield £1,300 a year, which, for a period of 18 years, would give £23,400. The royalties were only a deferred part of the purchase price of the stations. The contract was not performed, and the stations were not erected, for the reason that the defendants repudiated the contract. What happened was this: There was a provision in the contract whereby it was made to require the sanction of the House of Commons. There was no provision for withdrawal, nor was there any provision for the time within which the sanction of the House of Commons was to be obtained. After the making of the contract, and before the Parliamentary sanction had been obtained, the defendants made known to their shareholders the advantages of the contract, and immediately after that date the scandal arose as to the American Marconi shares, and a committee of inquiry was appointed. For this reason it appeared to be an unfavourable moment to invite Parliamentary approval of the contract. In the result, the defendants abandoned the contract, but the plaintiff had nothing to do with that. Afterwards when a calmer atmosphere prevailed a similar contract was made. The plaintiff said that he did his part, and was entitled to his commission, notwithstanding the fact that the defendants did not carry out the contract. Another important question for the plaintiff was the contract entered into for the sale by the defendants of their business in Australia to a new company, together with all their contracts with the Australian and New Zealand shipping companies. The plaintiff submitted that the sale was one upon which he was entitled to a commission, but the defendants said that it was not a sale within the meaning of the agreement, and that it did not take place until after the termination of the plaintiff's agreement.

MR. HAMILTON, the plaintiff, gave evidence as to the royalties he had received and those to which he considered himself entitled in respect of the installations. He said that he had done a considerable amount of work in getting the Australian Navy equipped with wireless telegraphy. In 1911 he introduced Mr. Marconi and Mr. Godfrey Isaacs to the Ministers of Defence on their visit to this country, when the question of equipment of warships with installations was discussed. He gave evidence as to the part he had taken in obtaining the contracts for New Zealand and Australia and in relation to the high-power stations, and said he was asked by the defendants through Mr. Godfrey Isaacs to stay in England to discuss the question of the Imperial chain, the result of which was that the contract was made on July 19th, 1912, between the Marconi Co. and H.M. Postmaster-General.

The hearing was adjourned.

(*To be continued.*)

OSRAM LAMP LITIGATION.

(*Continued from page 42.*)

MR. HORATIO BALLANTYNE was called to give evidence for the defendants. He said that in 1904 there was no manufacture in this country of incandescent electric lamps made with anything but carbon filaments. In Vienna an osmium filament lamp was made, but only on a small scale. The carbon filaments were made by the soft-paste process. The modern hard-paste process was quite different. Tungsten in a very fine condition of sub-division was mixed with a small quantity of sticky lubricating substance. It was not necessary to use a material capable of making a filament by itself. This mixture of metal and binder was rubbed together in a cup or a mortar with a pestle, and when the mixing seemed to be about complete, the substance was passed between steel rollers for the operation of calendering. Thus the material was reduced to a leathery consistency. It was then rolled up and put into the chamber of a hydraulic press capable of exerting a very high pressure. The die through which the material was pressed consisted of a diamond finely perforated, and as the filament was pressed through the die by the press it was received on to a card. By this time the filament consisted mainly of metallic tungsten, which adhered together because of the pressure to which it had been subjected in going through the die. The organic material with which the tungsten had been mixed was merely a lubricant to enable the powder to be forced through the die in the form of a filament. Having got the filament to that stage, the organic substance played no more useful part in the process.

When the filament is made by the hard paste process described, said MR. TERRELL, and is brought to a high temperature, do you consider that is carbonisation?—In my opinion, no. The proportion of carbon with the original mixture in defendants' process prior to any evaporation of the constituents of the binder amounts to about 12·29 parts for 100 of tungsten metal. There is, of course, no carbon as such present in the filament, but the constituents of the binder contain chemically combined carbon to that extent. The constituents of the binder are to a large extent volatile, and during the process of calendering, followed by the drying operation, a large proportion of the volatile matters are expelled so that of this 12·3 per cent. of carbon, which they originally contain, only about 2 per cent. of carbon is left before any heating takes place at all beyond the drying. Proceeding, witness said that on heating in the furnace, the amount of carbon left became only about 0·2 per cent., so that to him, as a chemist, the production of 0·2 per cent. of a substance, which might be called carbon, out of 12·29 per cent. of carbon was not carbonising, in the sense in which any scientiest, skilled in this art, would have understood it in 1904.

Later, witness said that he had made a filament by the soft-paste process, which he understood the specification sued upon to mean. He used tungsten of collodion, which he denitrated before carbonising the filaments. After carbonisation the filament contained 8 per cent. of carbon. The filament was then brought to a state of bright incandescence in an atmosphere of moist hydrogen. After the carbon had been burnt out the filaments were left more or less of a porous character. In making these filaments he passed direct current through them. The first time he saw filaments treated in bulk by external heat was in 1913, and he was greatly surprised to see filaments produced in that way with such fine results. In the specification sued upon the process described was substantially the process described in Welsbach except that tungsten was substituted for osmium. In his view, the conditions laid down in Just and Hanaman involved a soft-paste process.

Is there anything, inquired counsel, resembling Pope's process, either in the plaintiffs' specification or in the Welsbach specification, or in anything you have ever seen?—There is no real resemblance between the Pope process and the process described either in Welsbach or in the plaintiffs' specification.

Proceeding, witness said defendants' process differed from the

process in Just and Hanaman or in Welsbach by the very small quantity of binder used, in the difference from the industrial point of view of the process and plant used in preparing the filament, and by the continuous working of the furnaces.

This continuous working of the furnaces prevented any adventitious moisture getting to the filaments, as it was said to do in the "Z" case. Moreover, if the specification sued upon were wide enough to include hard-paste filaments, there was no sufficient description to enable him to make a filament with zinc-chloride cellulose.

You did your best, suggested MR. TERRELL, and so far as following the directions given in the specification went you utterly failed, but after a good deal of practice and bringing the knowledge up-to-date, in one or two cases you succeeded in getting some sort of a filament?—Yes.

Have you tried cupro-ammonia cellulose and tungstic metal?—Yes, and I agree that they would fail with hard or soft paste; but with hard paste I think I could make something if you do not tie me down to using a binder at all, but taking a little water and squirting the mixture.

Now assuming that you use the class of binding media referred to in the specification sued upon and produce a filament, is the equalising process a necessity?—To get a good filament, yes, because the filament after decarbonising is a very porous irregular filament, and, in fact, when you switch on current so as to make it incandescent, you see as a rule spots of bright and dull illumination. That is not satisfactory in a filament, and to remedy the defect equalisation of some sort is necessary.

Witness was then cross-examined by MR. WALTER. He said he did not know that Welsbach had used gum for his binder in 1904. In a subsequent specification for making a filament of oxide and metal, Welsbach did suggest gum.

As you make a material stiffer, suggested counsel, the pressure required to squirt it becomes greater?—If you start at the soft paste stage you can increase the thickness of your paste over a large range of consistency, and still be able to extrude it through the jet by means of the usual apparatus and get a filament. But the apparatus sets a limit to the increase of stiffness to which you can go.

With soft paste you simply use materials, pressures, and so on of a strength requisite to squirt a very soft plastic material?—Yes.

In the other you use the identical apparatus strengthened?—No. Whether you look at the process from the practical, the technological, or the scientific standpoint they are two totally different things.

In 1904 was what you now know as the hard-paste process perfectly well known?—Not to my knowledge.

Take Welsbach 13,116 of 1898; he is directly telling you to keep down your binding agent as well as you can?—Yes, but not for making a metal filament. This is a composite filament composed of oxide of thorium with so much metallic tungsten as will make it conductive. Witness added that he did not say that there were not in 1904 known methods of making stiff mixtures of materials which were used to form into rods.

Should I be wrong, inquired counsel, in saying that from 1898 to 1904 there were an immense number of people at work on filaments?—There certainly were a large number of specifications published between those dates.

From 1898 to 1904, although the suitability of tungsten was well known, nobody has described how to make up a tungsten filament by a built-up process?—No.

Gulcher used another metal of the platinum group, and he pointed out that for the purpose of sintering a metal filament there was no need to use an electric current?—Yes, in the preparation of his iridium filament.

Have you ever tested the effluent gas that passes from the bottom of the furnace in defendants' hydrogen process?—By analysis, no.

Temperatures such as you obtain in defendants' furnace are sufficient to cause steam to oxidise carbon?—I think they are.

PROF. F. G. DONNAN, Professor of Physical and Inorganic Chemistry at University College, said in evidence that there was no distinction between plaintiffs' method of removing carbon from the filaments and one of those described in Welsbach. A considerable difference existed between the method of heating the filaments by current and that of heating them by external heat. Where the filaments were composed of a relatively non-coherent material heating by direct current would be the better. But in the defendants' process, when the filaments were put into the first furnace, heated up to 950° C., only the non-volatile portion of the binder remained. This was not removed by the action of steam or water vapour as prescribed in the specification sued upon.

MR. A. C. CHAPMAN also gave evidence. Generally, he said he agreed with what Mr. Ballantyne had said,

MR. F. J. GILL, of Peoples Hall Works, Birmingham, said in evidence that between 1908 and 1909 he had studied the specification sued upon with a view to putting the directions given in it into practice. He used the soft paste method in his experiments, thinking that to be indicated, carbonised the filament so obtained and treated it in an atmosphere of steam and hydrogen to remove the carbon.

What was the result, inquired MR. HUGHES?—WITNESS: It burned out very rapidly.

What do you mean by that?—It scintillated. It oxidised the carbon particles so rapidly that it caused scintillation and the filament broke.

Cross-examined by MR. WALTER, Witness said that he knew the Osram Co. had made filaments on a large scale, but he could not tell when they started.

Did you ever make a filament under that specification?—No. I was never successful in getting a filament.

Do you know they were being made by the Osram Co. in 1908?—They were making them by a process unknown to me.

MR. T. A. ROSE also gave evidence from a filament-maker's point of view. He said he first heard of metal filaments being made in this country in 1908, or about then. For the purpose of this action he had taken the specification sued upon and tried to make a filament in the way he would have put it into practice in 1904. Without importing into the specification any knowledge of hard paste, which did not exist in 1904, he had done his best with the specification. In most cases he failed entirely. In others his results could only be called filaments by courtesy.

In your experience as a practical lampmaker, inquired MR. TERRELL, are there enough instructions in that specification to enable a filament-maker to make filaments?—I should say no.

This concluded the evidence.

Counsel having addressed the Court for their respective clients, his Lordship reserved judgment.

(To be continued.)

BRISTOL TRAMWAYS AND CARRIAGE CO., LTD.

MR. JUSTICE NEVILLE, in the Chancery Division on Tuesday, July 13th, sanctioned a petition by this company to an extension of its memorandum and articles enabling the company to manufacture aeroplanes, armed motor-cars and the like, and supply electricity to others.

The matter was before the Court on June 8th, when his Lordship expressed his approval of the alteration, but notice of the necessary meetings of the company had not been given in time.

MR. CLAUSON, K.C., in support, stated that fresh meetings had been held, which were duly in order, and his Lordship made the order as asked.

CRACKED AND SEIZED PISTONS ON DIESEL ENGINES.

THE following is an abstract of the remarks made by Mr. GEO. E. WINDELER (Chief Engineer to Messrs. Mirrlees, Bickerton and Day, Ltd.) before a meeting of the DIESEL ENGINE USERS' ASSOCIATION last month:—

In dealing with the internal-combustion engine as a heat motor, the points of difference between it and the steam engine are considerable. In the steam engine, to obtain the most economical results, everything possible is done to keep the temperatures of the cylinder liner, piston and ports for the incoming steam, and all surrounding spaces, as near as possible to the temperature of the live steam.

Now, in the internal-combustion engine (in this particular instance I will deal specially with the Diesel engine) everything possible is done to keep down the temperature of the cylinder liner, cylinder cover or breech end, exhaust valves and exhaust passages which are in contact with the fuel or gases. In some types the pistons are water or oil cooled. In a well-designed Diesel engine 40 per cent. of the heat units admitted to the combustion space is absorbed in useful work. Of the remainder, 25 per cent. passes to the exhaust and 35 per cent. passes away to the circulating water and is lost in radiation, so that almost as much heat has to be absorbed by the cooling water as is developed in useful work; therefore special attention has to be paid to water-cooling arrangements to ensure that the circulation is thorough and that no air or steam pocketing is likely to occur, and to the arrangements to prevent short-circuiting in the water circulation, otherwise certain parts are liable to become overheated locally.

In the course of our investigations we found that the major portion of the defects that had arisen on cylinder covers and pistons was due to serious deposits having been allowed to form in the water spaces of the cylinder covers and on the cylinder liners, and ultimately we came to the conclusion that such deposits were not formed on the liners and cylinder walls during the time the engine was working, but after the engine was shut down. Naturally, the piston, cylinder cover, valves, and such parts as are in contact with the combustion space must have a large number of heat units stored in them; when the engine is shut down these heat units are absorbed by the water which remains in the jacket, the quantity of which is comparatively small, and a very considerable rise in temperature takes place, in fact, sufficiently high in the majority of cases to throw down the salts which were held in solution in the water. We wrote to the various users of our engines suggesting to them, where the circulating water was known to be of a considerable hardness, that they should run water through the water spaces for some time after the engine was shut down—with the most happy results. Most Diesel engine users have now adopted this system, to their advantage.

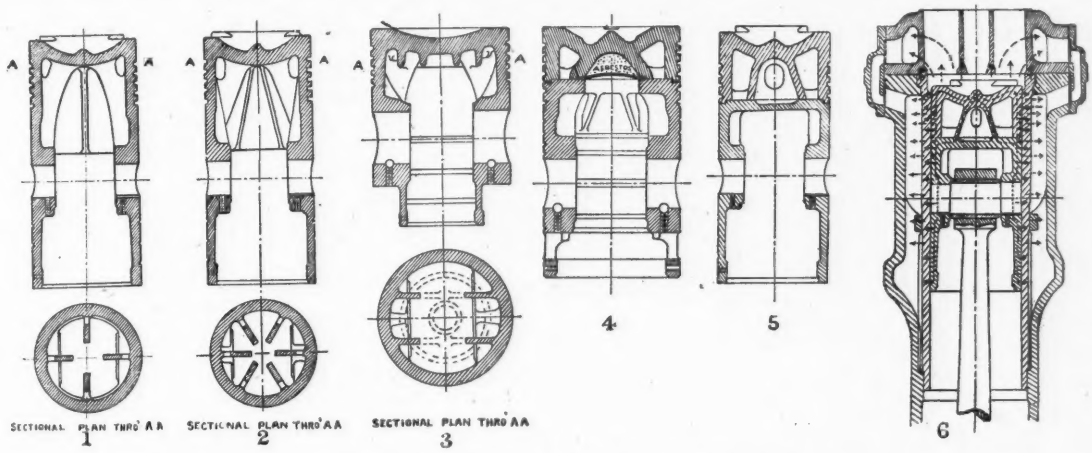
I have myself inspected a cylinder cover which contained a water space about 6 in. deep, and found a deposit 5 in. thick in the water space. Naturally, the cover had cracked. The aforesaid suggestion was adopted in this particular station, and the results have been very satisfactory indeed.

In an internal-combustion engine without a water-cooled piston, the heat units that have been absorbed by the piston

crown must of necessity be dispersed from the crown down the body of the piston, and passed away through the liner to the water space by the contact that the piston forms with the liner. It is, therefore, necessary to study carefully the design of the piston head to obtain the best results. At the same time, the piston must be designed in such a way that the load that is applied to the crown shall be transmitted to the crosshead pin which attaches to the connecting rod, without causing any distortion of the piston, which has to maintain its roundness to enable it to work without trouble in an accurately bored cylinder.

In large engines such as we have under discussion it is necessary to have a fairly heavy section of material to enable the heat units to pass away in the time available, so as to prevent undue heating of that part of the piston which is in contact with the gases.

In fig. 1 is shown a piston with the usual dished top which is supported by four radial ribs, two ribs being carried down to the piston pin boss so as to form a more or less rigid connection between the piston crown and the piston pin, to enable the forces to be transmitted direct with the minimum amount of distortion. It will be noted that this piston is comparatively thin in the crown and in the body, and when fitted to a number of engines, was found to work admirably; but ultimately distortions appeared between the ribs, and it was deemed advisable to modify the design to that shown in fig 2, in which six radial ribs are carried well down the body of the piston from the crown, two being carried to the piston pin boss, with a thicker rib behind the main rib to assist in the transmission of the load. The piston crown was made slightly thicker, and generally this design has been



FIGS. 1 TO 6, ILLUSTRATING MR. WINDELER'S REMARKS.

satisfactory, but at times cracks have developed in the piston top; sometimes the cracks have taken a circular form round the base of the centre cone which is formed in the piston. Such cracks, however, are not of serious import, and pistons which have cracked in this manner have been in use for twelve or fifteen months without any trouble, a slight blowing taking place when starting up, which ceases after the piston top has become heated, evidently the expansion closing up the crack. But a more serious state of affairs exists when the piston cracks either radially or diametrically, as it is liable to cause seizures in the cylinder owing to the piston losing its rigidity, and consequently its symmetry. It is desirable under such circumstances immediately to shut down and remove the piston.

Figs. 1 and 2 refer to a piston 12 in. in diameter; fig. 3 shows a piston 20 in. in diameter, the design of which was similar to the 12 in., but the piston crown was supported by a number of circular ribs projecting into the interior of the piston. Radial ribs were also carried down from the crown of the piston to the piston pin boss. This piston at first appeared to be quite satisfactory, but it was noticed on examining a number of castings that slight cracks had taken place across the tips of these ribs, and on examination it was found these cracks had been set up by the cooling of the casting.

A number of such castings were broken up and found to contain many flaws. It was, therefore, decided to cast the piston in two portions, and diagram 4 illustrates the type of piston which is now generally adopted by the firm. The upper portion is secured to the main body of the piston by six or eight square-necked studs; the object of the square-necked stud, which fits into a square hole in the body of the piston, is to ensure that the stud itself will not come out or get slack when the engine is at work.

The design of this piston top is somewhat novel, inasmuch as there are no ribs embodied in the design, the support to the crown of the piston top being obtained by throwing out a conical-cylindrical chamber, which also has the advantage that it forms another lane by which heat units can reach the body of the piston for transmission to the water spaces. It also permits of uniform expansion. The upper portion of the piston is carefully bedded on to the lower portion, and care has been taken to have sufficient contact area to allow for rapid heat transmission. The internal cone thus formed in the head is filled with asbestos to prevent the heat being thrown down from the crown of the piston on to the connecting rod bearing. This design has several advantages, one being that different qualities of material may be used for the upper portion of the piston and the lower portion. The other is that, should any cracks develop, it is a comparatively simple and inexpensive matter to replace the top. As will be readily understood, the lower portion, which acts as a crosshead, must necessarily be of a quality of iron which is hard and which will attain a high polish when running, and not wear readily; the upper portion should be of a material capable of resisting heat stresses.

Fig. 5 shows a similar design as adopted on the 12 in. pistons. When these modifications were carried out, a number of experiments and analyses were made by our laboratory with the different qualities of material used, and careful records were taken of such, and when any defects developed we were able to trace the particular quality of material that was used. By this comparative method we were able to arrive at a more or less definite conclusion as regards the quality of material which best suited the purpose. Ultimate experiments proved that cast irons containing high percentages of phosphorus were most unreliable, and further investigations proved that the elimination of phosphorus would, to a large extent, remove the difficulty of cracks developing. Great care is taken by us in controlling the mixtures that are used, and each batch of pistons and cylinder covers, liners, etc., is carefully analysed, and records taken by our laboratory so as to ensure consistency of the material as desired.

We have in the works an admirably equipped laboratory where analyses of metals, fuel, and lubricating oils are carefully carried out and difficulties investigated. In this laboratory is fitted one of our standard engines, which enables this department to carry out tests on different qualities of material under actual working conditions. Extensive tests, on different grades and qualities of fuel oils which are sent to us from all parts of the world, are also carried out. Quite recently we had this engine running on liquid tar and on tar oils, with satisfactory results.

Seizures of pistons almost invariably are due to heating of the piston pin and its bearing, and take place almost immediately after starting up. The opinion we have formed is that, when an engine has been set to work and shut down, the heat stored in the piston body is thrown down and tends to evaporate the oil in the top end bearing, with the result that when the engine starts up again, this particular bearing is not amply supplied with lubricating oil. Again, running the circulating water through the engine after shutting down, tends to minimise this difficulty.

In our enclosed type of engines, where forced lubrication is used, this difficulty is to a large extent removed by the fitting of a hand lubricating pump, by means of which lubricating oil under pressure can be pumped to all the bearings, including the piston pin bearing, whilst the engine is being barred round into its starting position before being started up.

As proof of our contention that the heating of this bearing is generally the cause of such seizures, I may mention that the abrasions generally show seizure to have taken place at four points of the circumference of the piston and liner, and if careful note is taken of the position of these abrasions, it will be found that they occur at the point where the piston pin bosses join on to the thinner section of the body of the piston. At this point there is a comparatively sudden reduction in the section of material, allowing one portion of the piston to be extremely rigid, and the other portion more or less flexible; when seizures take place the piston pin becomes overheated, and by reason of its friction fit in the piston body,

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plus its greater coefficient of expansion, causes an extension to take place, which forces the piston out of shape, flattens the crosshead portion of the piston body, and causes distortion to occur at the four points referred to. If the engine is not shut down quickly, other seizures are liable to occur, but the main seizures will almost invariably be found to occur at these four points.

When piston seizures do occur, it is desirable that the connecting-rod bolts should be carefully examined, as extension of the length of the bolt is likely to take place, and if examination is not made, ultimately fractures of the bolts are likely to occur, with most disastrous results.

WAR ITEMS.

War Loan.—The Underground Railways and allied companies have applied for £400,000 of the new War Loan in addition to a like amount of the original loan, which is being converted.

Messrs. T. Bolton & Sons, Ltd., of Widnes, are making a free gift of War Loan coupons and scrip vouchers to their 2,000 employés, the total cost to the firm being £10,000. They are presenting a £5 coupon to each employé over 18 years of age, and three scrip vouchers of £1 each to each employé under that age, who is still in the employ of the company at the end of the year, reserving the right to withhold same in cases of misconduct or neglect of work. The object is to enable the men to lay by something for themselves and encourage them to do their best in turning out work.

The Walsall Tramways Committee has decided to invest £15,000 in the War Loan.

The Hammersmith B.C. has invested £3,000 of the electricity reserve fund in the new War Loan.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., applied for £77,000 of the new War Loan.

Aberdeen Town Council Electricity Department has invested £5,000 in the War Loan.

It is announced that Messrs. Willans & Robinson, Ltd., have applied for £15,000 of the War Loan. Both this firm and the British Thomson-Houston Co., Ltd., are offering facilities to their workpeople at Rugby to buy vouchers.

As stated in the report of the annual meeting, appearing on another page, the General Electric Co., Ltd., has applied for £100,000 in the new War Loan, in addition to the £100,000 already held in the original Loan.

Kettering U.D.C. last week decided to apply for £2,200 worth of War Loan at 4½ per cent.—1925-45, the money to be taken out of the electric lighting reserve fund.

Other subscribers are as follows:—

Vickers, Ltd.	£100,000
Western Electric Co., Ltd.	25,000
Marconi's Wireless Telegraph Co., Ltd. ...	50,000
Phosphor Bronze Co.	7,000
British Ever-Ready Co.	5,000

Women in German Electrical Factories.—The "Daily Telegraph" Berne correspondent, referring to the increasing employment of women in German factories, says:—"Women are now employed on some of the largest German electro-technical factories, metal works and iron works, even for labour which it is doubtful that they are physically strong enough to permanently stand." Our readers are already aware that for years past a considerable number of women workers have been employed in the A.E.G. factories. Presumably the Berne correspondent means that the number of such workers has been increased.

Trade Openings Abroad.—France: An agent at Lyons wishes to secure the representation of United Kingdom manufacturers of glassware for electrical installations. Applications should be made, in the first instance, to the Board of Trade Commercial Intelligence Branch in London, and subsequently to the British Consulate at Lyons.

Italy: A firm wishes to represent United Kingdom manufacturers of water meters, electrical measuring instruments, and other technical articles for tramway, railway, and dock-yard use; also metals, worked and unworked. Application should be made, in the first instance, to the Board of Trade Commercial Intelligence Branch in London, and subsequently to the British Consulate at Milan.

Canada: A Montreal firm wishes to represent United Kingdom makers of steel tape to be used for covering lead electrical cables. Application, in the first instance, to the Board of Trade Commercial Intelligence Branch in London, and subsequently to H.M. Trade Commissioner for Canada, 3, Beaver Hall Square, Montreal.

Australia: A firm of agents in Brisbane wants to represent British makers of boiler covering and balata belting. A second Brisbane firm wants to represent in Australia British makers of dynamos, starters, switches and lamps. Application, in the first instance, to be made to the Board of Trade Commercial Intelligence Branch in London, and subsequently to H.M. Trade Commissioner for Australia, 81, Pitt Street, Sydney.

Metal Contracts: Australian Complaint.—Reuter dispatches from Melbourne appearing in the daily papers show that Mr. Hughes, the Federal Attorney-General, complains of the Imperial Government's inaction regarding metal contracts. He declares that German influence still prevails, and that it would be much more satisfactory if the Imperial Government declared its policy regarding metals.

A Canadian View of the Future.—At the recent convention of the Canadian Manufacturers' Association, says the "Financial Times," many important questions relating to the industries of the Dominion were discussed and a number of reports of committees of the Association were read. In an address in which he gave some views on the outlook for Canadian manufacturers, Mr. E. G. Henderson, the retiring President of the Association, expressed his judgment as follows:—"We should prepare ourselves for a period, not necessarily of hard times, but of tension, that will call for all the resourcefulness and enterprise we can command. I feel it will be a period that will witness on a considerable scale the weeding out of inefficiency, and place us under the necessity of cheapening our methods of production and improving the quality of our products. For this reason I attach great importance to the proposal that we should equip ourselves quickly and effectively for undertaking research work of every kind relating to our resources."

War-Time Contract Prices.—The Camberwell Borough Council approached the Local Government Board for their sanction to pay certain contractors extra amounts owing to the abnormal conditions created by the war. The Board have replied that, in the exceptional circumstances, should the Council decide to make any payment to a contractor in excess of the amount due under the contract, it should be considered by the Public Auditor at the audit as to its reasonableness, as in the case of other payments for goods supplied or for work done. The Board did not think that payments of this kind should be sanctioned by them before the audit, so as to prevent them being withdrawn from the auditor's review. Under these circumstances, the Council decided to make certain extra payments to their contractors above the contract prices, subject to the contractors giving an undertaking that, if the auditor declined to sanction the extra amount, they would refund it to the Council.

Board of Trade Inquiries.—List No. 28, issued by the Board of Trade Commercial Intelligence Branch, contains inquiries for the sources of supply of the following goods:—

Brass and iron parts, small.—Firms wanted to do the machining.
Insulating brushes and washers.
Small commutators.
Small dynamo armatures.
"Presspahn" or insulating cardboard.
Aluminium bronze wire in fine sizes.

Restricted Lighting.—At Whitley Bay Police Court on the 7th inst., Robert Simpson, manager of the Tynemouth and District Tramways Co., and Thomas Richardson, a driver under the company, were charged with having failed to reduce the inside lights of an electric car at Whitley Bay at 11.30 p.m. on June 19th.—Inspector Jackson said there were three bright, unshaded lights inside the car, and one on the rear platform. Only one blind on one side nearest to the sea was drawn. There was more light than was necessary. Since that date there had been a great improvement, and some of the cars were without lights.—Mr. Simpson said he had an interview with the military authorities in January, and they experimented with two cars. They tried various methods of shading, and in addition reduced the number of lights by half. He was not aware of any new order, but was willing to adopt any practicable suggestion to comply with the wishes of the authorities.—The defendant, Richardson, said he had no control over the lighting of the cars.—The Chairman of the bench said they thought the company were now attempting to keep down the lighting, but previously they had not done as much as they might.—Mr. Simpson was fined 20s., and the charge against the driver was dismissed.

Manchester Companies with German Capital.—At a meeting of the Manchester City Council last week, some discussion took place respecting the constitution of, and the origin of capital in, certain firms with whom it was proposed to place contracts, and the question was adjourned for a month, the town clerk undertaking to ascertain from Somerset House the proportion of German capital.

A Leeds Roll of Honour.—A roll of honour has been prepared of those members of the Leeds City Tramways who have joined the Army or Navy. The names of 604 men are inscribed in gilt letters on a handsome wooden tablet, together with the position they occupied on the tramway staff and there present military rank and regiment.

The Canals in War Time.—In the early days of the war the Waterways Association, with characteristic enterprise, obtained the ear of the Government for a suggestion that, when it became necessary artificially to create employment for the working classes, the development of our inland waterways should be considered a suitable relief work. Instead of the scarcity of employment then anticipated, there is, according to the "Birmingham Post," a dearth of hands to carry on the essential services of the country, and even on their present limited scale the canals could do with many more men efficiently to afford the carrying facilities of which they are capable. Like the railways, they have lost large numbers of their youngest and strongest workmen. But despite the heavy handicap under which they work, the canals are performing a very considerable national service. Barges are slower than trains in normal times, but not always in these days of railway congestion; and manufacturers and traders have in many cases transferred the traffic

the railway companies refused to the canals. While there is no boom in waterway transport, the canals are, however, and especially in the Black Country districts, proving specially useful in carrying engineering material with a promptitude that compares very favourably with the railways in these days. Evidently even the neglected canals are "doing their bit."—"Machinery Market."

The Victoria Falls Power Co.—Mr. Bernard Price, acting general manager of the Victoria Falls and Transvaal Power Co., has written a lengthy letter to the Johannesburg "Star," replying to certain questions raised by the Petitioners' Committee, in order to remove public misapprehension concerning the question of German influence in the company's affairs. The Committee asked whether the A.E.G. had a financial interest in the company, and to what extent, and whether it was true that the bulk of the machinery installed in the power stations, etc., was purchased in Germany. Mr. Price, in replying, states that the A.E.G. has no financial interest in the company. He says that the fact that a considerable amount of German machinery has been purchased by the company is readily explained. "In the first place, German banks put up the first mortgage loan required for the purchase of the initial plant, and, in the second place, suitable equipment in some instances could not be obtained in Britain at the date of purchase. The supply of electric power and of compressed air on the huge scale obtaining in this district is a very special business. The Power Company's electric scheme ranks as one of the three largest in the world, and the supply of compressed air in bulk is absolutely unique. It is not surprising, therefore, to find that some of the machinery and apparatus required for equipping such a scheme has not been obtainable from more than one or two firms. While manufacturers of electrical plant in Britain had, speaking generally, built up their businesses with the primary object of meeting the requirements of the relatively smaller schemes to be found in the United Kingdom, where distances are relatively small, voltages are relatively low, and the size of generating unit required is not very large, similar manufacturers abroad had developed designs suited to the larger schemes which had sprung up in their own country, and which schemes were comparable in size and voltage to that in this district. For these reasons my company was forced to purchase some items for the equipment of its stations outside Britain, and it will be found that a similar course was adopted by power companies controlling the largest scheme in Britain itself. It will be understood that these remarks only apply to certain items of equipment. My company has throughout purchased all boiler plant in Britain, and many other items have been ordered from British firms. In some instances also, American firms have competed successfully for my company's business. The power company was promoted by British interests, the Chartered Company taking an active part in its formation. The whole of the share capital was raised in England, and every endeavour was made to raise the first mortgage loan through financial houses in Britain and America, but these endeavours proved fruitless, and the first debentures were eventually raised in Germany. The second loan, however, was raised entirely in England. The directorate is entirely British. Not a single German has been employed by the company since the outbreak of the European War, and recently those few employés who, though naturalised, were of German extraction, have been discharged."

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Pocket Dry Batteries.

I notice in an article on pocket dry batteries ("A New British Industry"), on page 57 of your current issue, that your contributor states that the voltage obtainable from a single dry cell should not fall below 1·5 volts, using peroxide of manganese and graphite only as a depolariser. I have now been manufacturing these cells for some years, and have never been able to obtain this voltage, and it is a generally recognised fact that it is impossible to obtain this voltage in commercial samples. The most that I have been able to obtain is 1·4 volts, and this only for a few days. Most of the text-books on primary batteries mention that in practical working only one volt per cell should be reckoned on for a Leclanché cell, and this is what usually obtains in the pocket dry battery of ordinary construction. Attempts have been made to increase the voltage of these cells by special processes of manufacture and the use of other depolari-ers, and in many cases these have been quite successful; it is now quite possible to obtain cells giving 2 volts as their normal working voltage. As your contributor remarks, however, the secret of their construction is jealously guarded by their makers. I should like to have the experience of other makers on this subject.

Dry Battery Manufacturer.

Gas v. Electricity.

Your editorial comments entitled "Electricity Outclassed" are extremely welcome, and it would be of interest to learn:—

1. Why the generosity of the gas company was not manifest before the Council invited tenders from electrical contractors?

2. Why the electrical engineer should waste time on a stringent specification?

3. In view of the fact that the electricity was competing with gas, why it was not possible to frame the specification for a more economical wiring installation?

4. Who decided that 3/20 was to be the smallest cable used, although no point compr sed m re than a 50-C P metal-filament lamp, and the total wattage for the largest dwelling did not exceed 240 watts at 250 volts?

5. By what means the ELECTRICAL REVIEW secured the results of the tenders submitted, whereas competing firms are still ignorant of the result?

6. Whether it is more profitable for the Council to use the gas of a private company in preference to their own electricity?

7. If the Council would show the same noble spirit as is demonstrated by their selection in the form of 5 per cent. interest on the £29 deposits demanded before May 31st and not refunded by July 13th?

8. The advisability of increasing their staff, to permit of replies being sent to correspondents, who up to the present receive no ackn wledgment to their repeated inquiries relating to the above matter?

London, W., *July 13th*, 1915. W. El-les.

BUSINESS NOTES.

Book Notices. — *Colliery and Mining Machinery.* Part 1. (G.E.C. Bulletin, No. 7.) London: The General Electric Co., Ltd.—This work, issued by the General Electric Co., Ltd., is mainly intended to bring before the mining community the various classes of electrical machinery and equipment manufactured and installed by them, and the illustrations show examples of typical plant erected at collieries by this company. It is, however, not a catalogue, but a descriptive treatise on colliery electrical engineering, and in this respect is much superior to any text-b ok we have as yet come across. The volume, which consists of 182 pages, is divided into seven sections, commencing with "General Considerations," and ending with "Colliery Lighting," the other sections dealing with colliery power houses and sub-stations; motor-driven plant for collieries; colliery switchg-ar, &c.; colliery cables; and telephones. Each section deals thoroughly with the subject in hand, the first three being especially good, and a quantity of useful and valuable information is given, which ought to be particularly acceptable to the colliery manager or engineer, such as, for instance, that relating to standard pressures and frequencies, overloads in relation to the rating of machines, and temperature rise. Then there is the question of alternating *versus* continuous current, seven points being given in favour of the former, against two for the latter; the whole question is summed up thus:—"Taking a general view of the whole question, it would appear that alternating current possesses the advantage, except for very small installations." The selection of a suitable voltage and frequency, the type of prime mover, the advantage of utilising waste heat, types of generators, the advantages obtained by the use of rotary converters, the design and connecting-up of transformers, are all dealt with in a thoroughly practical way, considerable space being devoted to the description and operation of the last-named. The importance of obtaining a high power factor, and the much-debated point of "earthed *versus* insulated neutrals" are also discussed.

The two sections dealing with "Colliery power houses and sub-stations" and "Motor-driven plant for collieries" are both exceedingly interesting and instructive, especially the latter. In this section, synchronous and induction motors, phase-advancers, the various methods of motor protection, including pipe ventilation and drip-proof, totally enclosed, and explosion-proof motors, are briefly but practically considered. Then follow the applications of electricity to haulage, winding, pumping, &c., which are all exceptionally good sections, especially the first two named. Indeed, the article on winding is one of the best summaries of the various methods in use that we have seen, and is quite free from that extreme bias that one usually finds in works of this character.

The other sections are all equally good, and the reference to the G.E.C. gas detector is especially interesting. But is it a fire-damp detector? If so, we ought to hear more of it in the near future. The only electrical apparatus used in mines that are not mentioned are signalling appliances and miners' safety lamps. As regards the latter, these perhaps are not of much interest to the General Electric Co., but electric signalling, in view of recent investigations, and the new regulations in regard to winding signals, are, we think, of sufficient importance to merit attention. We can heartily congratulate the General Electric Co. on their enterprise in issuing such a valuable and interesting contribution to mining electrical literature, a copy of which should be in the hands of every colliery manager and responsible engineer.

"The Post Office Electrical Engineers' Journal." Vol. VIII, Part 2. July, 1915. London: H. Alabaster, Gatehouse & Co. Price 1s. net.

Bankruptcy Proceedings.—DENNIS RIPLEY BROADBENT, electrical engineer, 50, Hans Place, S.W.—The public examination was held on July 7th, before Mr. Registrar Hood, at the London Bankruptcy Court. The liabilities are returned at £1,160, and assets valued at sufficient to yield a surplus of £1,447 after payment of all debts. Questioned by Mr. E. Leadham Hough, Senior Official Receiver, the debtor stated that upon coming of age in May, 1890, he became entitled under the will of an uncle to about £5,000. In the same year he purchased for £2,500 an electrical engineering business at Putney, which had been carried on as J. D. F. Andrews & Co., Ltd. Witness was a qualified engineer when he purchased that business. In February, 1901, he sold it to a company, which he formed and registered as the "British Electrical Manufacturing Co., Ltd." In the meantime he had expended a further £500 in the business, making his total outlay £3,000. The sale consideration payable to him by the company was £7,650, of which he received £650 in cash, £5,000 in fully-paid shares, and £2,000 in debentures. Witness was of opinion that all the liabilities he incurred in connection with that business had been discharged. He acted as a director of the company, which was not successful and went into voluntary liquidation in January, 1902. The assets were comparatively trifling in value, and the proceeds of the realisation were absorbed in costs and expenses of the liquidation. Witness had not parted with any of his shares or debentures, and had, consequently, lost the whole of the £3,000 that he invested in the company. He had also acted as director and otherwise of another company, to losses in connection with which he also attributed his failure. The examination was formally adjourned for a fortnight, the Official Receiver stating that the first meeting of creditors stood adjourned to enable a proposal to be submitted to the creditors.

GEORGE EDWARD HIPKINS, electrical engineer, Dudley.—First and final dividend 3s. 3¾d. in the £, payable July 12th, by Official Receiver, at 1, Priory Street, Dudley.

HERBERT PAGE (Smeeton & Page), electrical engineer, 63, Queen Victoria Street, London, E.C.—Receiving order made July 8th on debtor's petition. First meeting July 22nd; public examination, September 7th, both at Carey Street.

Liquidations.—VENNER'S ELECTRICAL COOKING AND HEATING APPLIANCES, LTD.—A meeting of creditors will be held at Blomfield House, 85, London Wall, London, E.C., on Thursday, July 22nd. Liquidator, Mr. G. E. S. Venner. Creditors must send particulars to the liquidator, at 85, London Wall, E.C., by August 24th.

FLEETWOOD AND DISTRICT ELECTRIC LIGHT AND POWER SYNDICATE, LTD.—A meeting is to be held at 90, Cannon Street, E.C., on August 9th, to hear an account of the winding up from the liquidator (Mr. W. Cash).

CONSOLIDATED DIESEL ENGINE MANUFACTURERS, LTD.—July 29th is the last day for receipt of proofs for dividend. Liquidator, Sir W. B. Peat, 11, Ironmonger Lane, London, E.C.

Catalogues and Lists.—INDIA-RUBBER, GUTTA-PERCHA AND TELEGRAPH WORKS CO., LTD., 106, Cannon Street, London, E.C.—Illustrated circular giving a list of a number of special lines that the company is manufacturing, including testing sets, rubber gloves, motor-driven turbine pumps, steam-driven sets, ebonite sheet, rod and tube, gutta-percha articles, hose, &c.

THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—Twelve-page publication (V C 1,846), containing fully illustrated particulars and prices of the Santo vacuum cleaners, and attachments for same, also the "Little Briton," the "Perfection," "Magic," "Apex," "Cleveland," and "Economo" vacuum cleaners.

JACKSON ELECTRIC STOVE CO., LTD., 38, Blandford Street, London, W.—Two illustrated priced cards dealing respectively with rapid boilers and electric boiling pans.

NATIONAL BOILER AND GENERAL INSURANCE CO., LTD., St. Mary's Parsonage, Manchester.—Illustrated and priced descriptive circular concerning their National patent circulator for preventing external wasting of economiser pipes.

MESSRS. THOMPSON & CO., 48, Watling Street, London, E.C.—6-page descriptive illustrated list, with a number of diagrams of connections, relating to the "Rex" A.C. watt-hour meters for single, two and three-phase currents. These instruments are made throughout in Switzerland, by the firm's principals, the Société Genevoise pour la Construction d'instruments de Physique et de Mécanique, who have been established in Geneva over 60 years as manufacturers of scientific instruments.

Catalogues Wanted.—MESSRS. M. G. H. DEURA AND CO., "The Sports and Music Depôt," of Raja Street, Sialkot City, India, are about to start a new branch of their business dealing with electrical manufactures, and they desire to get into touch with British firms and to receive their catalogues.

Fabroil Pinions.—THE BRITISH THOMSON-HOUSTON CO., LTD., of Rugby, have received an order through G. & S. Massey, of Manchester, for 93 special Fabroil pinions for power hammers for the French Government to be used in a French munition works. The Fabroil pinion department of the B.T.H. Co is at present very busily occupied.

Accessories for Russia.—A firm in Odessa is anxious to hear from manufacturers of Edison screw lampholders, switches for 2 amperes at 250 volts, junction boxes, "Mignon" plugs, &c. Bankers' references are given. The address will be forwarded to British firms desirous of opening business relations with the South of Russia.

China.—H.M. Consul-General at Shanghai (Sir E. D. H Fraser, K.C.M.G.) reports that the importation of machinery and the installation of electric lighting apparatus in China is worthy of the closest study by British firms who are interested in the machinery market. China shows a vigorous and increasing demand for electricity in all its branches. The excellent progress of the Shanghai municipal electricity works is referred to, and the Consul continues:—"The installation of plant in the interior requires special measures, and cannot be attempted without efficient local representation. The business was largely in the hands of German firms, mainly because they were willing to undertake entire contracts and to finance them. British firms, however, have realised the possibilities of the market, and those who have been sufficiently enterprising to meet the local conditions are being amply repaid for their trouble, whilst their work has given the greatest possible satisfaction to the Chinese companies on whose behalf contracts have been undertaken. British installations have recently been completed for the great cities of Soochow, Changchow and Yangchow, in the Province of Kiangsu, and for Ningpo, in the Province of Chekiang, whilst a very large number of smaller plants and dynamos have been supplied for lighting small towns, missions, and factories."

Large Capacity Stokers.—The 16-retort Erith-Riley stoker, as built by ERITH'S ENGINEERING CO., LTD., of London, has, we are informed, the largest capacity of any stoker in use. Four of this size are in use in one plant. Its normal capacity is no less than four tons of coal hourly, and it has 50 per cent. overload capacity. Each stoker is applied to an undivided furnace of a single water-tube boiler, 25 ft. wide. The capacity of this stoker is equal to that of a battery of eight large Lancashire boilers, occupying a site 100 ft. wide. The use of such large-unit boilers is naturally confined to central electricity stations; but the entirely automatic working of the Erith-Riley stoker permits unlimited unit capacity. The stoker is of the inclined underfeed type, with the fires kept continually sliced and the ash continuously discharged by reciprocating tuyeres and ash-pushers. The air for combustion is delivered direct to the tuyeres by a suitable fan, and both air and fuel automatically respond to load variations. Each stoker consists of a series of standardised and interchangeable retort-units; four boilers, each with 4-retort stoker, or two boilers, each with 8-retort stoker, will, therefore, give identical results to the above-mentioned boiler, with one 16-retort stoker.

LIGHTING and POWER NOTES.

Aldershot.—PLANT EXTENSION.—The U.D.C. has decided to purchase an engine for the electricity works from the Nuneaton T.C., for £650.

Bacup.—A report has been prepared showing the result of a canvass, and the applications for supplies of current, along the line of a proposed mains extension in Burnley Road, and a Sub-Committee has been deputed to go into the matter, with power to take such action as may be deemed advisable.

Barrow.—PLANT EXTENSION.—The electrical engineer reported that a large local firm had been taking 1,500 KW. almost continuously for some weeks past, and were in urgent need of an increased supply, and, with that in view, he recommended the erection of the additional cooling tower, for which a loan had been sanctioned; he also reported that it was necessary to obtain a fan and motor to increase the draught, as owing to the number of boilers in use, the chimney at the electricity works was of insufficient capacity to give the required draught.

Bedford.—The T.C. has decided that the following be a condition of supply of current for power purposes:—For every 6d. increase in the price per ton for coal over and above 13s. 4d., the rate per unit be increased by ·016d. A sum of £1,500 from the electricity department's reserve fund has been invested in the War Loan.

Belfast.—PRICE INCREASE.—The Corporation has increased the price of electricity for power purposes by ¼d. per unit, and by ½d. per unit for lighting purposes.—*Freeman's Journal.*

Bradford.—PROPOSED LOAN.—Application is to be made to the L.G.B. for sanction to borrow £20,000 for new mains, &c., required for extensions necessitated by Government requirements.

The Electricity Committee recommends the Finance and General Purposes Committee to support the action of the I.M.E.A., which has made representations urging that the Government should hold itself financially responsible for all damage to real and personal property situated within the British Isles directly attributable to the present war.

An agreement has been entered into with Messrs. H. Longbottom and Co. with respect to a bulk supply of electricity to their mill.

The electrical engineer has been requested to prepare a report as to the advisability of sinking wells in Valley Road for the purpose of obtaining water for the electricity works.

Bromley (Kent).—PRICE INCREASE.—The T.C. has received notice from the Electric Lighting Co. of an increase in the charges for current for all purposes, of 10 per cent. as from the end of the present quarter.

Burton-upon-Trent.—YEAR'S WORKING.—The annual report of Mr. Thos. Hall, the borough electrical engineer, on the working of the Corporation electricity department, for the year ended March 31st last, shows that the net surplus amounted to £2,566, as compared with £3,056 in the previous year, but as against this decrease £878 was expended on capital account out of revenue, and the usual financial charges were £1,336 higher, due to the recent reconstruction of the power station. The total output sold was 2,914,820 units, of which the major portion, 1,493,288 units, were for power; 104,404 units were sold for heating (double the amount in the previous year); the lighting output also increased, while traction supply decreased. The maximum load was 1,405 KW., and the load factor 25½ per cent. Despite increased output, the coal bill was £600 down, making a saving of £1,213 in two years, due to the use of the new turbine plant. The total working costs amounted to '686d. per unit (coal, '205d), and the commercial cost (all in) was 1'3d. per unit sold. Mr. Hall points out that the opening of the showroom, even at a critical time like December, 1914, has had satisfactory results. During the first three months of this year 81 radiators of 213 KW. were sent out; three electric cookers are giving a satisfactory trial, while there has been a fair demand for other apparatus. The total revenue for the year was £18,658, or £1,534 more than in the previous 12 months.

The Lighting Committee of the T.C. has decided to enter into an agreement with electrical contractors regarding the hiring out of apparatus.

Canada.—With a capital of three million dollars and extensive power privileges, a new electric company has been incorporated at Quebec to develop hydraulic powers in the cities of Three Rivers and Quebec, and also in various counties between the two cities. The promoters are Montreal men, and the company expects to furnish electricity to Quebec Trois Riverois, also in the municipalities of Lewis, Beauce, Dorchester, Portneuf, Mentmagny, Megantic, Champlain, St. Maurice, Charlevoix and Saguenay.

Cheam.—RESTRICTED LIGHTING.—The South Metropolitan E.L. Co. has informed the P.C. that it will charge only half the contract price for public lighting from June 10th until normal lighting recommences, and the Council has accepted this offer.

Chesterfield.—NEW PLANT.—After declining to sanction a loan of £5,000 for new plant for the electricity works, the L.G.B. has now requested the T.C. to forward a block plan of the works showing the existing and the proposed new plant.

Church Stretton.—PROV. ORDER.—The U.D.C. has referred to the Finance Committee an intimation that a prov. order for E.L. is being applied for by the Electric Supply Co.

Clacton-on-Sea.—LOAN SANCTION.—The L.G.B. has sent the U.D.C. sanction to a loan of £950 for a new battery for the electricity works. The Council applied for £1,300, and the L.G.B. deducted £350, being £779 outstanding debt on the old battery, less £429 allowed for old material. The loan is sanctioned on the understanding that whatever the actual cost of the battery is, £350 will be defrayed out of current income. Owing to inability to obtain a loan for new cables, the Council has had to defer the laying of certain mains for the present.

Colchester.—PRICE INCREASE.—The T.C. has decided to increase the price of current for lighting by ½d. per unit.

Consett.—STREET LIGHTING.—As a result of negotiations with the Cleveland and Durham Power Co., it was stated in Council that the lighting of the streets will cost nothing during the next 15 years; hitherto the Council has paid £800 a year for this service.

Continental.—SPAIN.—A small central electric lighting station has lately been completed and put in operation in the little town of Sarria (Province of Lugo). The water power of the River Tuliero is utilised.

Donaghadee.—PROV. ORDER.—The B. of T. has agreed to defer the revocation of the Urban Council's electric lighting order for a year as from August next.

Durham.—STREET LIGHTING.—The T.C. has accepted the offer from the Electric Power Distribution Co., to quote terms for the public lighting of the city.

Edinburgh.—The Electric Lighting Committee recommended that the estimated deficit on the income for the year of £6,200 should be paid out of the reserve fund, and that the charge for electric lighting be increased by ½d. per unit, making the new rate 2½d. The price for power remains at the present rate of 1½d. per unit.

Elland.—PRICE INCREASE.—The Council has decided to increase the price of electricity for power by 12½ per cent., except in cases of agreements.

Ellesmere Port.—PROV. ORDER.—The B. of T. has informed the U.D.C. that it will defer the consideration of the revocation of the E.L. order for a year from August 15th next.

Frome.—The U.D.C. has informed the Electricity Supply Co. that it has no power to increase the price of current supplied to the Council under its agreement; the company, however, points out that the increase applies only to the current used at the sewage works, and the matter is to be further considered by the Finance Committee.

Great Harwood.—PROV. ORDER.—The B. of T. has granted an extension of the electric lighting order until August, 1916.

Hastings.—YEAR'S WORKING.—The annual accounts of the electricity department, for the year ended March 31st, show that the income amounted to £25,226, a decrease of £111 on the preceding year; the expenditure was £12,732, as compared with £12,467, and the gross profit £12,494, as compared with £12,870 in the year 1913-14, a decrease of £376. After payment of interest, sinking fund, and all outstanding charges, there was a net profit of £845, which was carried to profit and loss account. In the preceding year the net profit was £1,297. The number of units generated was 1,383,072, and sold, 1,277,072. The load factor of the undertaking was 22'77 per cent., and the generating plant capacity 1,850 KW.—*Hastings Observer.*

Heckmondwike.—PRICE INCREASE.—The Electricity Committee has decided to increase the charges for electricity by 10 per cent., with a discount equivalent to such increase if payment is made within a specified time.

Hendon.—PUBLIC LIGHTING.—At the meeting of the R.D.C. last week, it was stated that for the public lighting of Pinner a tender was invited from the National Electric Construction Co., which asked to be excused as the capital expenditure would be such that its quotation would be very high.

Lepton.—PROV. ORDER.—The U.D.C. has agreed to receive a deputation from the Electrical Distribution of Yorkshire, Ltd., with reference to its proposal to apply for a provisional order to supply electricity for lighting in Lepton and other districts.

Lincoln.—YEAR'S WORKING.—The report of the Corporation electricity department for the last year shows that the total output sold was 2,291,114 units, an increase of 9 per cent. on the previous year, the increased sales being in general power units for the Co-operative Society's Flour Mill, and in lighting largely due to hospital supply. The total works costs were '753d. per unit (coal '256d.), and the commercial cost (all in) was 1'242d. per unit. Fuel cost was reduced by 26 per cent. owing to a reduction in cost of coal and the use of turbo-alternating plant for most of the supply, 4'13 lb. per unit being required as against 5'2 lb. The gross profit for the year amounted to £7,831, as against £6,792, and the net surplus to £3,163, as against £2,715 in the previous year.

London.—HAMMERSMITH.—The Finance Committee recommends that application be made to the L.C.C. for sanction to the borrowing and advance of £8,313 to defray the B.C.'s proportion of the cost of the Battersea, Fulham and Hammersmith scheme for linking up the electricity undertakings.

In consideration of the reduction in street lighting, the sum of £150 per quarter is to be allowed off the charges from the quarter ending December 31st last, and during the period of restricted lighting.

The Electricity Committee reports that the Shepherd's Bush Exhibition Co. has agreed to the use of its mains for the supply of energy to premises situate in the exhibition grounds, in consideration of the Council paying the company 15 per cent. of the receipts for current supplied for power and lighting purposes to occupiers other than the company, and 12½ per cent. on receipts for cooking, heating, &c. The Committee recommends the Council to agree to this arrangement.

BERMONDSEY.—The Street Lighting Committee of the B.C. has considered complaints that some of the streets are too brilliantly lighted, and has given instructions for the electrical engineer to experiment by blacking the tops of some of the lanterns.

Market Drayton.—STREET LIGHTING.—The U.D.C. has accepted the offer of the E.L. Co. for public lighting at the following terms:—Existing lamps contiguous to the mains, with 100 C.P. lamps, from August 1st to May 31st, from sunset to midnight, £2 1s. per lamp; any seven similar lamps, all the year, from sunset to sunrise, £3 10s. each; connect each standard to the existing mains and fix with bracket and reinstatement, £2 10s. per lamp, or, without new brackets, £1 12s. 6d., payable in three equal instalments; lamps not contiguous to the mains to be connected with overhead wires at the same charges.

Melbourne (Derbyshire).—STREET LIGHTING.—The P.C. has invited the E.L. Co. to tender with the Gas Co. for the public lighting of the parish.

Nantwich.—Consent to supply electricity to Berkeley Towers has been given to the Crewe Corporation by the R.D.C.

Newcastle-under-Lyme.—YEAR'S WORKING.—During the last financial year the Corporation electricity department earned a gross profit of £1,632, as compared with £1,473 in the previous year, and a net profit of £255, as against £205. The output sold was 200,064 units (maximum load 182 KW.), and this included 91,000 units sold for power, as against 40,000 in the previous year. Due largely to the improved day load, fuel costs fell 27 per cent., and total working costs by about ½d. per unit; other factors were a fall in average price of oil fuel from 81s. to 70s. a ton, and the use of a new storage battery, avoiding night shifts. Due to the war the works are short staffed, but the engineer, Mr. de Renzi, considers that the department will be able to avoid increasing the price of energy to consumers, which result will be largely due to the use of Diesel engines.

Queensbury.—PROV. ORDER.—A subsidiary company of the Yorkshire Power Co. has informed the U.D.C. that it is intended to apply for a prov. order for E.L. The Council has decided to discuss the matter with the representative of the company at the September meeting.

Redditch.—YEAR'S WORKING.—The accounts of the electricity undertaking for the year ended March 31st last show that the balance carried to net revenue account was £617, as compared with £962 in the previous year. The net result of the year's working was a loss of £2 508, as compared with £3 351 in 1912-13. During the year 1,283,937 units were sold, as against 1,433,666, a decrease of 149,739 in 1914-15. The fuel account was reduced by '03d. per unit, although the cost of coal had increased by 2s. per ton. The decreased output was due to failure of the turbine plant, which affected the power supply.—*Evesham Journal.*

Rotherham.—INCREASED PRICES.—The T.C. has decided to increase the price of current for lighting by ½d. per unit as from the quarter commencing October next.

Settle.—The R.D.C. has refused to allow the Bentham Electrical Supply Co., Ltd., to place overhead wires on the highway.

Sevenoaks.—Messrs. Young & Son have carried out an expeditious E.L. installation at a military camp. Within 24 hours of the receipt of the order current was ready for use in the officers' mess. The supply is from the mains of the local Electric Supply Co.

Shanklin (I. of W.).—RESTRICTED LIGHTING.—The U.D.C., having asked for a larger reduction than that offered in the public lighting charges based on the lamps used, the Isle of Wight E.L. Co. has declined to agree, adding that a similar situation has arisen at Ventnor, where the correct interpretation of the contract is to be settled by an arbitrator, and asks that the Council should await the decision, leaving its offer of reduction based on the number of units of current not consumed as still open for acceptance. The matter has been referred to a Committee.

Sheffield.—NEW PLANT, &C.—Mains are to be extended in various parts of the city, at an approximate cost of £3.660. The general manager has reported upon the difficulty in obtaining a sufficient supply of water for condensing purposes at Neepsend during the summer months, owing to the prior rights of the Old Park Silver Mills Co., Ltd., and negotiations have been opened for the transfer of the rights of controlling the water to the Corporation. The Electric Supply Committee is of opinion that there is no present necessity for increasing the existing charges for current. In view of the short terms allowed by the L.G.B. for the repayment of money borrowed, the Finance Committee has decided to defray the cost (£3,614) of two water cooling towers out of revenue. The Electric Supply Committee, in view of the heavy demands now being made upon the department for power supplies, has decided to install a small plant (2,000 KW.) which will enable the department to connect a further 5,500 KW. without reducing the margin for spares. The plant has been offered by the British Westinghouse Co., and is partly constructed; the price is approximately £8,500, and the foundation and pipework amounts to about £2,000 in addition, and application is to be made to the L.G.B. for sanction to a loan of this amount.

YEAR'S WORKING.—The surplus on the working of the electricity undertaking for the year ended March 25th last, amounted to £25,837, and the general manager recommends that a further sum of £14,000 be transferred to the renewals and special expenditure fund (making the total transferred to date, £59.000), and that £10,000 be transferred to the reserve fund. During the period covered by this statement there was an increase in the total units sold of 18,000,000, or 68 per cent., and an increase of 684 consumers, or 11 per cent. War allowances and increased wages to employés since the commencement of the war amount to £2,103. The total number of units sold during the 12 months amounted to 44,873,342, at a total cost of '42d. per unit.

South Africa.—The Mossel Bay (Cape Prov.) Municipal Council proposes to seek authority from the ratepayers to increase the amount of the approved loan for electric lighting purposes to a sum not exceeding £13,000.

St. Helens.—PROPOSED LOAN.—The borough electrical engineer having reported that it would be necessary to install an additional generator before the winter of 1916, the Electricity Committee has decided to apply to the L.G.B. for sanction to borrow £14,000 for extensions to the electricity works.

Stafford.—The T.C. has decided from September 30th to charge consumers of current a minimum rate of 7s. 6d. per quarter. Under the order there is power to charge 13s. 4d. per quarter for any quantity of current up to 20 units.

Stockton.—There was a profit of £448 on the Corporation electricity undertaking for the past year.

Swansea.—Due to a reduction in the supply to the Swansea Tramways Co. the number of units generated at the Corporation works during the past quarter shows a reduction, and the borough electrical engineer (Mr. Barr) has suggested to his Committee that the Corporation should offer to supply the whole of the tramway company's requirements. The suggestion is being adopted.

Torquay.—The T.C., at the request of the L.G.B., has agreed to postpone the uncompleted portion of the contract for generating plant until after the conclusion of the war. The plant was to have cost £11,000. It was stated that the 1,000 KW. generator could be sold at a profit, which would enable the Committee to replace it at a later date.

Walsall.—The Electricity Committee has decided not to make any increase in the tariff charges at present. Instructions have, however, been given for the withdrawal of the 2½ per cent. discount for payment of accounts within one month, and the engineer has been authorised to disconnect the supply of any customer who does not pay his account within one month of the delivery of the same. Negotiations as to the price to be charged for traction supply are now pending.

Warrington.—ANNUAL ACCOUNTS.—The returns of the electricity undertaking for the past year show receipts of £25 419, and expenditure £16 858, leaving a gross profit of £8,561, compared with £9,199 in the previous year. After all charges have been met the net profit is £1,819, compared with £2,935 in 1913-14. The reserve fund stands at £9,358; loans taken up during the year amounted to £13,800, making the total borrowing powers exercised £120,376. The amount of debt extinguished is £39,282, leaving loans outstanding of £81,095.

Westhoughton.—STREET LIGHTING.—The D.C. has sought a reduction of one-half in the amount of the last quarterly account with the Lancashire Electric Power Co. for street lighting on the ground that lamps were not lighted by order of the military authorities. The company, however, has refused to allow the deduction, but the Council is addressing a further letter to it on the matter.

West Ham.—YEAR'S WORKING.—There was a gross profit of £36,032 on the electricity undertaking for the 12 months ending March 31st last, a decrease of £6,447 as compared with the previous year. The income was £134,074, an increase of £568, as compared with 1913-14. The result of the operations of the sales department was a net surplus of £594. The net revenue account includes loan charges amounting in all to £43,009 (an increase over the previous year's figure of £1,165), also special expenditures amounting in all to £2,278, which leaves a deficit of £8,852. Having considered the income and expenditure accounts of the electricity undertaking for the year ending March 31st last, together with the borough treasurer's report thereon, the Electric Lighting Committee recommends that the Finance Committee be requested to include the deficiency of £8,852 in the supplemental estimates at September next. The Committee has decided to enter into new agreements with six firms in substitution for existing agreements, consequent on the increased charges for current recently adopted by the T.C.

West Yorkshire.—PROV. ORDERS.—The Yorkshire Electric Power Co., Ltd., has given notice of its intention to apply for power to supply electricity for lighting and other purposes in various districts. The Royston U.D.C., the Barnsley T.C., and the Lepton U.D.C. have agreed to meet a representative of the company; the Skelmanthorpe U.D.C. has left the matter over until the next meeting, and the Denby and Cumberworth U.D.C. has decided to submit the notice to the West Riding District Councils' Association. Notices have also been served on the Penistone and Horbury U.D.Cs.

HOSPITAL LIGHTING.—The L.G.B. has approved amended proposals submitted by the W. R. County Council for electric lighting at the Middleton Sanatorium, and has agreed to make a grant of £18,000 towards the cost of the Institution.

Weymouth.—PROPOSED LOAN.—The T.C. has applied to the L.G.B. for a loan of £2,200 for necessary cables and services.

Wimbledon.—PROV. ORDER.—The town clerk is to give the necessary notices of the intention of the Corporation to apply to the B. of T. for a prov. order to supply electricity within the area of the Parish of Cuddington.

TRAMWAY and RAILWAY NOTES.

Barrow.—The T.C., in consideration of certain track improvements and additions, has agreed to make a special rebate of ¼d. per unit from the schedule in the 1902 agreement with the B.E.T. Co. for all electricity used over and above 400,000 units per annum. On last year's basis of energy used this would mean a reduction of the account by £136; there is, however, every probability of a larger use of energy.

Birmingham. — FEMALE LABOUR. — The Tramways Committee has authorised the engagement of women to replace conductors who have enlisted. Their duty will be limited on the average to seven hours a day, and the pay will be at the same rates as already obtain in the service.

Bradford.—TRACK RENEWAL.—The Tramways Committee proposes to renew the tramway track in various parts of the city, at an estimated cost of about £15,000.

The Works Sub-Committee recommends an increase of £4 15s. per truck, in the case of the tender of the M. & G. Truck and Engineering Co., Ltd.

The general manager having reported upon the difficulties experienced and likely to arise in maintaining an efficient tramway service owing to depletion of the skilled staff of the department in consequence of Army enlistment and engagement of workmen for war service, the town clerk has been requested to communicate with the Army authorities on the subject.

Burnley.—YEAR'S WORKING.—The annual report of the Corporation's electrical tramways shows that as a result of the war, the receipts fell by £9,769, while working expenditure decreased by £6,924. The amount paid to the electricity department for power was £17,611. About 50 per cent. of the staff have joined the Forces, and up to March 31st the amount of allowances made to these men was £2,483. Of the balance of £5,069, £1,664 was allocated to the rates, and nothing placed to the reserve fund.

Continental Notes.—ITALY.—The electric railway scheme under construction by the Società delle Ferrovie Vicinale, connecting Rome with Fiuggi and Frosinone, and some 23 other towns and localities, and having, with its various branches, an extent of 135 km., is likely to be opened to working by the end of the present year, instead of August, 1916, the period stipulated by the contract with the Government. Although nominally a tramway, the line is practically a railway, having stations for passengers and goods traffic, telegraphic equipment and rolling stock in keeping with this character. The line is only a stepping stone to further developments contemplated by this company, which will render the Lazio Meridionale one of the regions best served by railways in Italy. The Banca Commerciale has financed the undertaking, the Italian Thomson-Houston Co. supplying the electric equipment, the Savona and Piombino works of the firm of Ilva furnishing the steel work, and the Società di Carrozerie Breda, of Milan, the rolling stock.—*Revista Tecnica d'Elettricità.*

SPAIN.—Plans have been prepared in respect of a projected electric tramway between Palma and Esporlas, in the Balearic Isles.

Doncaster.—The T.C. has referred back to the Electricity and Tramways Committee for further consideration the latter's recommendations with regard to the repair of the Bentley tramway track.

Hull.—FEMALE LABOUR.—The tramwaymen, says the *Standard*, have withdrawn their resolution to cease work as a protest against the employment of women conductors.

L. & Y. Railway Electrification.—The electrification of this company's branch line from Bury to Manchester, by way of Prestwich, is stated to be nearly completed. Trains have already been run experimentally over certain sections, energy having been supplied by the Manchester Corporation. It was hoped to open the line to the public this month, but the war has caused delay in fitting and equipping the big power station which is being erected by the company near Clifton Junction.

Leeds.—EXTENSIONS DEFERRED.—The City Council has decided that in view of the request of the Treasury with regard to the curtailment of expenditure on new work, several tramway extension schemes shall be deferred until the war is over. The extension of the tramway system from York Road terminus to the Manston Fever Hospital, and the scheme for linking up Guiseley with Otley and Burley-in-Wharfedale by means of railless cars are to be completed; the chief scheme deferred is that which would have provided railless cars for Morley.

London.—L.C.C. AND LONDON ELECTRIC RAILWAY CO.'S FACILITIES BILL.—The Parliamentary Committee recommends that in view of the support which the Bill is receiving from various quarters, of the attitude of the B. of T. and of the present Parliamentary situation, the Council should not take any further action on the Bill.

The Highways Committee reports that the powers obtained for the construction of certain tramways included in the L.C.C. (Tramways and Improvements) Acts, 1909 and 1913, and not yet constructed, will expire in August, 1916, and recommends that application be made to Parliament in the session of 1916 for an extension of the time allowed for the construction of the undermentioned tramways from: Farringdon Road north-eastward into Clerkenwell Road; from Battersea Park Road north-westward into Battersea Bridge Road; from Southcroft Road south-westward into Mitcham Road; tramways in Bridge Road, Hammersmith, and junction line leading from the Broadway, Hammersmith, into Bridge Road.

Rochdale.—The T.C. is to be recommended to allow the shell of the new repair shed at the car depôt to be completed, the understanding being that payment to contractors is withheld until the end of the war, the Corporation meanwhile paying interest on the contractors' outlay.

The application of tramway workers for an advance in wages in lieu of the present war bonus is to stand over for a month, when the war bonus question is due to be reconsidered.

South Shields.—YEAR'S WORKING.—The Tramways Committee reports that the net surplus on tramway revenue account for the year ended March 31st was, approximately, £5,500, and that £3,100 will be available for transfer to the reserve fund.

Stockport.—WAR BONUSES.—The T.C. has refused applications for war bonuses for tramway and other workers in municipal departments.

Walsall.—The Tramways Committee reports that Messrs. W. A. Stevens, Ltd., have delivered the second 'bus of the six ordered from them, but, owing to the works being temporarily withdrawn from the firm's control, further deliveries cannot be made yet. Messrs. Stevens, however, have offered a vehicle with a saloon body, for £1,050, complete, which can be suitably altered for £200, and the Committee recommends its purchase.

Warrington.—The municipal motor-'buses show a loss on the year's working of £554. The gross profit was £56, compared with £406 for the nine months of the previous year. During the year 771,510 passengers were carried.

Wigan.—TRACK RENEWAL.—The Tramways Committee has under consideration an expenditure of about £3,000 on sinking the groove of the rails on the narrow-gauge routes by means of the Woods-Gilbert rail planer. It is estimated that this would extend the life of the rails by five or six years, during which period a depreciation fund could be built up towards renewing the rails at a cost approximating to £30,000.

Wolverhampton.—YEAR'S WORKING.—The accounts of the Corporation tramway undertaking for the year ended March 31st last show a total revenue of £55,323, and working expenses amounting to £34,605. After repayment of loans, interest, &c., there was a net balance of £9,160, of which £5,416 was transferred to reserve and renewals fund, and £3,744 to the borough rate account. The passengers carried numbered 12,236,785.

TELEGRAPH and TELEPHONE NOTES.

Illicit Wireless Apparatus.—At Prahran, Victoria, Mathew Henry Read, a mechanic in the Postal department, was charged with having in his possession an apparatus capable of being used for tapping messages sent by wireless telegraphy. It was not suggested that he used the apparatus to assist the enemy. Defendant was fined £20, with £4 4s. costs.

The Telegraph Service.—Lord Midleton, in a speech in the House of Lords on the need for economy in Government Departments, recently pointed out several ways in which savings might be effected in the Post Office. He mentioned particularly the loss of £1,250,000 on the telegraph services, partly due to the cheap rates for Press messages, and suggested that the loss might be avoided by raising the rates. On the average a telegram costs the Post Office about 11d. to transmit, while the average payment for a telegram is only about 7½d. But the rate per word and the minimum charge per telegram, as well as the rates and hours for Press messages, were laid down in detail in the Telegraphs Act of 1885, and cannot be varied without legislation.

Wireless in Australia.—The Federal Government in May appointed a Royal Commission to inquire into certain matters in dispute between Mr. J. G. Balsillie, Commonwealth radio-telegraph engineer, and Father Shaw, inventor of the Shaw wireless system. One of the matters involved in the inquiry is whether a wireless system similar to that which the Commonwealth is now operating was previously patented by Father Shaw.—*Sydney Daily Telegraph.*

Wireless Station Sequestrated.—The U.S. Government has taken possession of the Sayville wireless station, the only remaining direct means of communication between the United States and Germany. Various newspapers have been charging the Germans with deceiving the United States by the use of a newly-invented system, by means of which a secret message could be sent between the words of innocent-looking messages without the knowledge of the Censor. The station will henceforth be worked by United States Navy operators. The secret code is said to be based on the principle of long and short silences between letters and words in unimportant messages, instead of long and short sounds. Skilled Morse operators can easily communicate without detection.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—MELBOURNE.—Aug. 11th. One 1,000-KW. D.C. generator complete, liquid starter, &c., for the City Council. See "Official Notices" June 4th.

ADELAIDE.—August 18th. Magneto and trembling bells, for P.M.G.'s Department. See "Official Notices" July 2nd.

August 18th. Battery material, for the P.M.G. See "Official Notices" July 9th.

August 25th. Dry cells, earth clips, recording counters, and various other instruments and apparatus, for the P.M.G.'s Department. See "Official Notices" July 9th.

September 1st. Condensers, testing sets, rheostats, Morse sounders, and Wheatstone transmitters, for the P.M.G.*

PERTH.—August 11th. Bolts and nuts, tubular brackets, side brackets for tubular iron poles, &c., Cordeaux and other insulators, copper wire, &c., for the P.M.G.'s Department. See "Official Notices" July 2nd.

August 11th. Measuring instruments, for the P.M.G. See "Official Notices" to-day.

SYDNEY.—September 13th. Council. A.C. and D.C. electric motors. Specification (10s. 6d.) from E.L. Department, Town Hall.*

September 6th. Metropolitan Board of Water Supply and Sewerage. Centrifugal pumps and electric motors at Richmond pumping station.* Acting Secretary, 341, Pitt Street, Sydney.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

Barking Town.—July 16th. U.D.C. 1,000-KW. turbo-alternator with condensing plant; cooling tower and pipework; chain-grate stoker, boiler pipe work, &c.; economiser; rotary converter; H.T. switchgear; H.T. mains. See "Official Notices" July 2nd.

Dublin.—July 26th. Corporation. High and low-pressure cables and accessories, transformers, transformer pillars and electricity meters. See "Official Notices" to-day.

Edinburgh.—July 19th. Corporation. Tenders for the works required in connection with the erection of the new electric generating station, Westbank, Portobello. Sir A. Kennedy, 17, Victoria Street, Westminster, Engineer.

July 17th. Corporation. Three, six, nine or twelve months' supply of electrical materials. Forms from Resident Electrical Engineer, Dewar Place.

Erith.—July 19th. U.D.C. One 2,000-KW. turbo-alternator, with condensing plant, switchgear, and all accessories. See "Official Notices" June 18th.

Hull.—July 22nd. Machinery oils for the Corporation Electricity Works.

July 22nd. Corporation. One 5,000-KW. turbo-alternator with exciter and condenser outfit complete. See "Official Notices" July 2nd.

Morecambe.—July 24th. Corporation Electricity Department. 2,000 tons of coal or slack. See "Official Notices" July 2nd.

Portsmouth.—July 19th. Electric wiring and fittings, Wimborne Road Schools, for the Education Committee. Mr. G. C. Vernon-Inkpen, Architect, 40, Commercial Road.

Rotherham.—July 24th. Corporation. 10,000 tons smudge and pea nuts; single vulcanised bitumen-covered cable, H.T. cable, rubber-insulated cable, trolley wire; ampere-hour meters. See "Official Notices" to-day.

Sheffield.—July 30th. Water service conduit screen chamber, penstocks, valves, piping, &c., for the Electric Supply Committee. Forms of tender from Mr. S. E. Fedden, General Manager and Engineer.

South Africa.—BEAUFORT WEST (CAPE).—September 14th. Municipality. Suction gas engines, dynamo, booster, switchboard, battery, &c.; also poles, copper wire, insulators, street lamps, service connections, meters, &c. Specifications, on deposit of five guineas (returnable), from Chas. G. Trevett, A.M.I.E.E., 70, Fletcher's Chambers, Cape Town. Tenders to Town Clerk, Beaufort West.

CLOSED.

Australia.—SYDNEY.—The City Council received the following tenders for disconnecting switches and fuses:—

W. G. Watson & Co., £420; alternative, £792.
Australian General Electric Co., £1,413 (recommended); alternative, £1,154.

Bedford.—The T.C. has accepted the following tenders for coal for the electricity works:—

Ellis & Everard, Ltd.—1,500 tons Bentinck Derby slack, at 19s. 4d. per ton.
J. E. Page & Co.—2,000 tons Manners Kilburn slack, at 19s. 10d. per ton.
Mr. Chas. Franklin.—3,000 tons Moira ½-in. slack, at 15s. 3d. per ton.

Bradford.—The Tramways Committee has accepted the offer of the British Thomson-Houston Co., Ltd., of a pair of ventilated type tramcar motors, now on trial in the tramways department, for £210.

The Electricity Committee has accepted the offer of Messrs. Ferranti, Ltd., to supply six various transformers; that of the Brush Electrical Engineering Co., Ltd., to supply two various transformers; and that of Messrs. Wright & Wood, Ltd., to supply 23 motors in connection with the electricity supply to Dumb Mills.

Colchester.—The T.C. has accepted the tender of Messrs. Mellonie & Goulder, Ltd., for the supply to the electricity works of 5,500 tons of Tibshelf best hard nutty slack, at 19s. 6d. per ton.

Dover.—The T.C. has arranged with the Snowdown (Kent) Colliery for a three months' supply of washed beans for the electricity works, at £1 6s. 1d. per ton.

Eccles.—The tender of Mr. E. Beal has been accepted by the Education Committee, at £60, for wiring the Anson Street School and supplying the fittings.

Gillingham (Kent).—The T.C. has accepted the following tenders for coal for the electricity works:—

Spenser, Whatley & Co.—200 tons D.S. nuts, at £1 6s. per ton.
Blackman & Co.—200 tons Cannock ⅝ slack, at £1 1s. 3d. per ton.

G.N. Railway.—The General Electric Co., Ltd., has secured a yearly contract from the Great Northern Railway Co. for the supply of standard Osram drawn-wire lamps and for Osram Atmos-type lamps.

Grangemouth.—The burgh authorities have accepted the tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for the supply of tantalum and Wotan lamps for the ensuing 12 months.

Keighley.—The Electricity Committee recommends that the offer of Messrs. Willans & Robinson, Ltd., of a 5,000-KW. turbo-alternator (G.E.C. alternator) for £16,975 be accepted, subject to satisfactory arrangements being made for deferring payment of the purchase money; also that the necessary foundations, piping, switchgear, &c., be constructed and provided, at £3,025.

Leeds.—The Leeds City Council has accepted the tender of the Leeds and Bradford Boiler Co., Ltd., for six steam separators, at £358.

Leek.—The U.D.C. has accepted the tender of the Anglo-American Oil Co., Ltd., for 150 tons of fuel oil for the electricity works; and that of the Littleton Collieries, Ltd., for washed nut coal to the works for a year.

London.—METROPOLITAN ASYLUMS BOARD.—The following tenders have been received for the installation of electric light in four blocks at the Grove Hospital:—

Titan Lift Co., Ltd. .. .. .. (recommended)	£540
Alpha Manufacturing Co.	552
C. H. Cathcart & Co.	600
Toy & Winslow	632
Green & Abbott, Ltd.	637
W. C. Tackley & Co., Ltd.	663
Napier Kimber, Ltd.	882

L.C.C.—The Stores and Contracts Committee has accepted the following tenders for 12 months from July 1st, 1915:—

Iron castings for the permanent way, &c., for the Tramways Department, Schedule 91.—J. Martin & Sons, items 4, 5, 6 and 7.
Steel and iron castings, Schedule 92.—Hadfields, Ltd., items 1, 2, 3, 5 and 6.

FULHAM.—The Electricity Committee recommends acceptance of the following contracts for coal as required for the electricity works:—

Myers, Rose & Co., Ltd.—2 000 tons Mansfield 1¼ N.S., at 21s. per ton.
Cory Bros. & Co., Ltd.—2 000 tons Hawkins Old C. 1-in., at 20s. 4d. per ton.
Blackman & Co.—2,000 tons Hucknall 1¾ in., at 20s. 6d. per ton.
Phillips & Co.—500 tons Pinxton ¾-in., at 19s. 9d. per ton.
Blackman & Co.—1,020 tons Great Wyrley 2-in., at 20s. per ton.

Mirfield.—The U.D.C. has accepted the tender of Mr. E. Liversedge, Huddersfield, amounting to £33 10s., for providing and fixing electric overhead mains at Upper Hopton.

Peterborough.—The Electricity Committee of the T.C. has accepted the tender of Messrs. J. Fairweather & Co. for Tibshelf peas coal, at £1 0s. 9d. per ton.

Rotherham.—The Corporation has accepted the tender of Scottish Commercial Cars Co., Ltd., for three motor-omnibuses, at £959 each.

Salford.—The T.C. has sealed a contract with the British Westinghouse Electric & Mfg. Co., Ltd., for a high-tension cubicle and control panel for the Electricity Department.

Sheffield.—The offer of Messrs. Meade, King, Robinson and Co. to extend their contract for the supply of petrol to the Tramways Department from January 1st, 1916, to December 31st, has been accepted by the Tramways Committee; as have also the tenders of Messrs. Cammell, Laird & Co., Ltd., for the supply of 500 steel tramcar tires, and Messrs. Brown, Bayley's Steel Works, Ltd., to supply three special sets of 50 tires each. The Electricity Committee has accepted the tender of Messrs. W. Marlow & Sons, at £1,087, for the erection of a transformer sub-station in Fowncett Street.

Stockport.—The T.C. has accepted the tender of Messrs. Hadfield's Steel Foundry, Ltd., at £205, for a tramway lay-out in manganese steel.

Wimbledon.—The E.L. Committee has accepted the tender of Messrs. E. Foster & Co. to supply the following quantities of coal during a period of 12 months:—

5,000 tons Kingsbury Ryder small nuts, at 23s. 10d. per ton.
2,000 tons Elverton (South Leicester) 1½-in. nutty slack, at 20s. 7d. per ton.
1,000 tons Kingsbury 1¾-in. nutty slack coal, at 21s. 10d. per ton.
1,000 tons Nailstone 1½-in. slack coal, at 20s. 9d. per ton.
2,000 tons Ibstock (Deep seam) D.S. nuts, at 21s. 9d. per ton.

Wolverhampton.—The Tramways Committee has decided to purchase 12 motor equipments from Messrs. Dick, Kerr and Co., Ltd., at a cost of £1,380.

A LOW-PRICED ELECTRIC VEHICLE.

If there is one point on which, in the past, the electric vehicle has failed to convince would-be purchasers, it is on the question of high first cost. Whether the latter has been justified, in a commercial sense, we do not know, but it is, of course, admitted that there are many instances where the adoption of a comparatively costly electric vehicle has resulted in a subsequent saving in running costs and increased convenience and handiness associated with that type of vehicle.

On the other hand, it must also be admitted that there are many business men who cannot reconcile the first cost of the electric, of which cost they are in no doubt, with the estimated saving in working expenses, which, so far as they are concerned, is, after all, only an estimate.

First costs which are high, judged by accepted standards, will always present an insurmountable barrier to many people, as witness the number of carbon lamps still used in places where metal-filament lamps would show a great saving in the lighting bill.

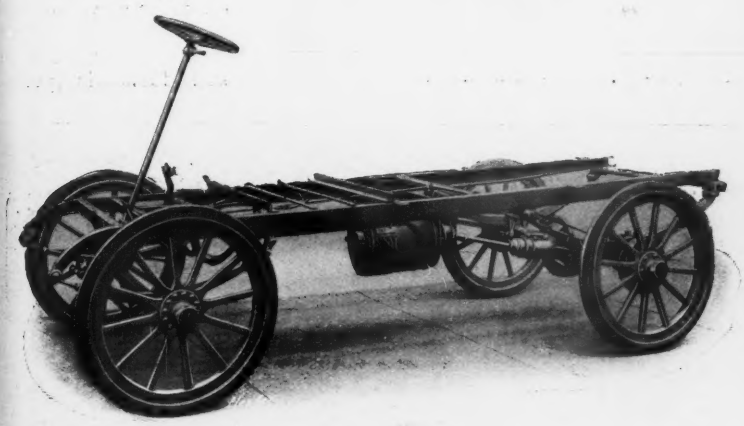
In the case of the electric vehicle it is not easy to justify the high initial cost, and this is generally recognised by the central station communities both in America and this country, where there is considerable scope for the use of a low-priced machine, capable of meeting average conditions of town delivery and showing a saving on present methods. The demand for such a vehicle has been met in the States, by the Ward Motor Vehicle Co., of Mount Vernon, N.Y., who have introduced a high grade delivery van with a rated carrying capacity of 750 lb. and a radius of operation of 35 to 45 miles on one charge, which sells at the low price of $875 (£175) complete.

This vehicle, known as the "Ward Special," we illustrate herewith; the chassis is simple in construction, with channel and bar main framing, and drop forged steel axles with Timken bearings; the rear axle has a pressed steel housing for differential and helical gears. Wheel steering is provided, of the minimum lost motion type, and the road wheels are artillery pattern with 2½-in. tires. The electric equipment consists of a 42-cell 9-plate Ward Philadelphia battery, covered by a guarantee, and this supplies energy to a Westinghouse heavy duty series-wound motor driving through a propeller shaft to the rear axle; a controller of the continuous torque type gives four speeds ahead and two reverse.

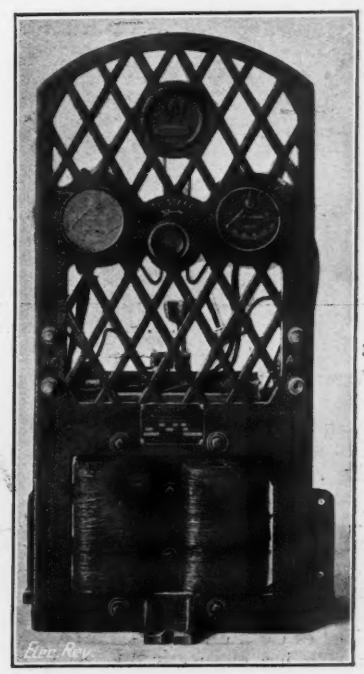
Our illustration shows a van body, which is built up with steel panels giving light weight and strength combined. The same vehicle fitted with the Ironclad Exide battery is sold for $1,000 (£200), and with the Edison battery, for $1,350 (£270).

The "Ward Special" Electric Vehicle.

The "Ward Special" has a level road speed of 10 miles per hour, or about twice that of the horse, and less than half the stable room is required as compared with a horse and van. Many of these vehicles have been placed in service and have given a very good account of themselves; we publish herewith the results of a 30 days' test which bears out the makers' claims as to its serviceable qualities, and it is further interesting to note that the Ward Co. is so satisfied with the efficiency of its vehicle that in the New



Chassis of the "Ward Special" Electric Van.



Ward Rectifier Charging Panel.

E

York district it has offered a five-year maintenance guarantee, whereby the customer is assured that his expense under this head shall not exceed four cents per car-mile, reckoning an average daily mileage of 25.

To facilitate the use of the Ward vehicle in districts where only alternating current is available, the Ward Co. has introduced a simple form of Westinghouse rectifier outfit for battery charging from 60-cycle, 220-volt single-phase circuits. This gives an automatically tapering charge to the battery, and only necessitates the insertion of the charging plug, closing a switch, and turning a handle to rock the mercury bulb of the rectifier.

The Ward Co. build standard electric trucks up to 10,000 lb. capacity, and it is their claim that if the Ward Special were sold at twice the present price, they could not make it any better than it is being made to-day.

A cheaper type of vehicle is essential to the popularising of the "electric," and the Ward Co. are to be congratulated on having courageously set out to produce in such quantity as to make the marketing of a low-price high-grade vehicle a practical possibility.

Analysis of Performance for 30 Working Days of Ward Special.

Days operated	30
Miles travelled	1,140·5
KW.-hours used	319·5
Number of miles per KW.-hour	3·57
Greatest energy consumption for one day	13 KW.-hr.
Smallest energy consumption for one day	10 KW.-hr.
Average energy consumption for one day	10·65 KW.-hr.
Shortest run	33·5 miles
Longest run	46·5 miles
Average run	38·01 miles
Greatest merchandise load*	1,500 lb.
Smallest merchandise load	500 lb.
Average merchandise load*	1,000 lb.
Current cost per car-mile at 3 cents per KW.-hour	$0·008
" " " 4 cents "	$·011
" " " 5 cents "	$·014
Maintenance (maximum estimate), including repairs and renewal of all mechanical and electrical parts, including tires, battery, and painting of wagon, should not exceed per car-mile	$·04

* The rated merchandise load capacity of this car is 750 lb. The above performance was, therefore, accomplished with an average overload of 250 lb. of merchandise, and in no instance was the car run with less than 500 lb. of merchandise on the springs.

THE CENTRAL POWER STATION OF THE RANDFONTEIN ESTATES.

By R. TURNBULL MAWDESLEY.

It would seem that the prominence deservedly given, in the columns of the technical Press, both at home and in America, to the four power stations—namely, Rosherville, Vereeniging, Simmer Pan and Brakpan — jointly operated by the Rand Mines Power Supply Co., Ltd., and the Victoria Falls and Transvaal Power Co., has somewhat eclipsed the remaining power undertakings in these fields.

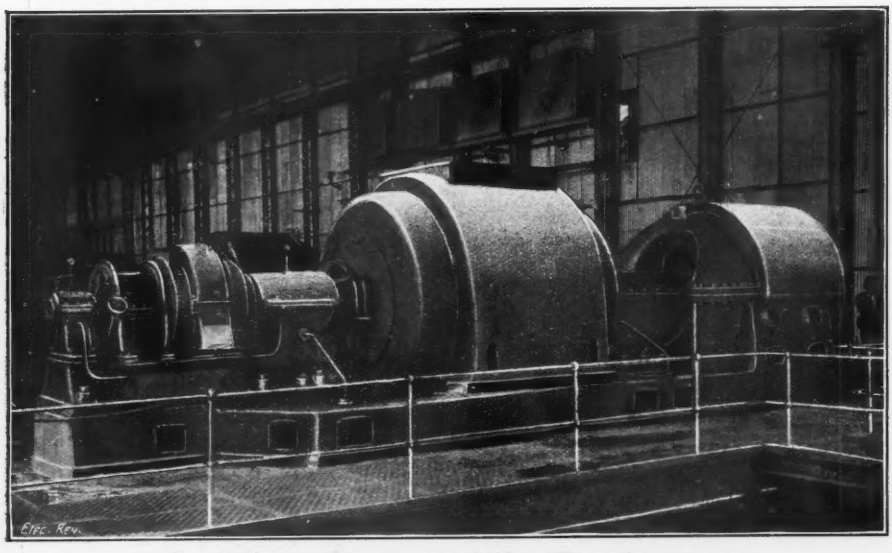


Fig. 1.—British Westinghouse 6,000-kw. Turbo-Alternator.

The Randfontein Estates electrical undertaking has not received more than a brief reference in the English electrical journals, though its importance and the one or two unique features of the plant certainly warrant a clearer recognition.

Briefly and generally, the Randfontein Estates Gold Mining Co. is an amalgamation of smaller companies, the controlling interest in which is held by Sir Joseph B. Robinson. This company owns and operates a number of mining properties on the extreme west of the Rand. Ten main shafts have been sunk on reefs, which are known as the Randfontein Leader and West Reef, and which are all outcrop propositions extending from two miles west of Krugersdorp, to about one mile beyond Randfontein village—a distance of about seven miles, as shown on the surface plan on page 81.

The power station (fig. 3) is situated near the Robinson railway station of the South African railways, at a point which is approximately the centre of gravity of the load distributed, and supplies power to the 10 shafts for hoisting, pump-

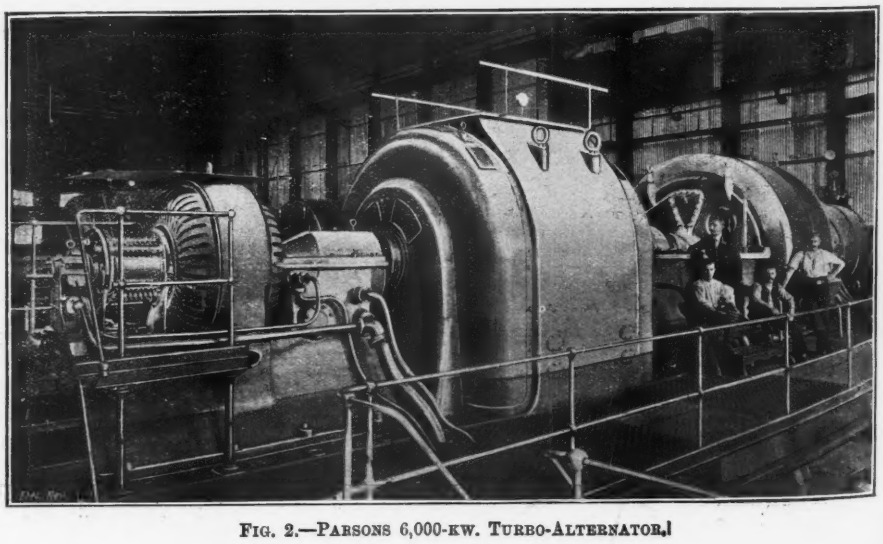


Fig. 2.—Parsons 6,000-kw. Turbo-Alternator.

ing, &c.; it also furnishes energy for a large number of stamp mills, air compressors, and other necessary appliances.

The whole of the generating plant at present installed is turbine-driven, and consists of two 6,000-KW., three 2,000-KW., and two 1,000-KW. Parsons turbo-alternators, and one 6,000-KW. Westinghouse set, making a total capacity of 26,000 KW.

A general view of the interior of the power station, looking west, is shown in fig. 5.

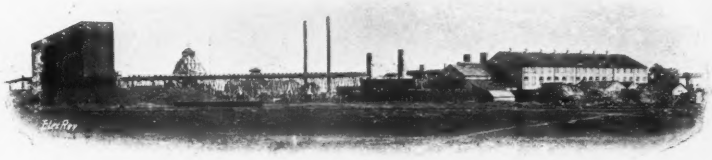


FIG. 3.—PANORAMIC VIEW OF POWER STATION BUILDINGS.

The latest addition to the plant is the last-named 6,000-KW. set, which consists of a Westinghouse-Rateau impulse turbine, running at 1,500 R.P.M., and driving a 6,600-volt, 50-cycle, 3-phase alternator of the compensated type. The exciter is fitted to the end of the main shaft, and has a radial commutator; the alternator slip-rings are also radial. This machine has a surface-condensing plant situated directly below the turbine exhaust, which is of the Westinghouse-Leblanc type, with electrically-driven air and extraction pumps. The circulating pump is driven by a 275-H.P. three-phase motor. The condensate, which is measured by a Lea recorder, passes into a hot-well common to the three 6,000-KW. machines, and is taken from that point to the feed tanks by small motor-driven rotary pumps, in triplicate.

In starting up this turbine a small duplex steam pump is used to furnish oil for the bearings, which pump is automatically cut out as soon as the turbine oil pump, driven by wormgear from the main shaft, is giving sufficient pressure. The latter pump, besides supplying oil at about 7 lb. per sq. in. pressure for the bearings, provides oil at approximately 70 lb. pressure for operating the turbine governor. The lubricating oil, in its return journey from the bearings, passes through an oil cooler, which is supplied with circulating water from duplicate boiler cold-feed tanks placed outside the station proper. This circulating water is quite distinct from the condenser circulating water, which is unfit for this purpose. A small motor-driven rotary pump supplies the cooling water for the Westinghouse 6,000-KW. set cooler, and also for the two Parsons 6,000-KW. sets, which are provided with a gravity oil system, described on a later page.

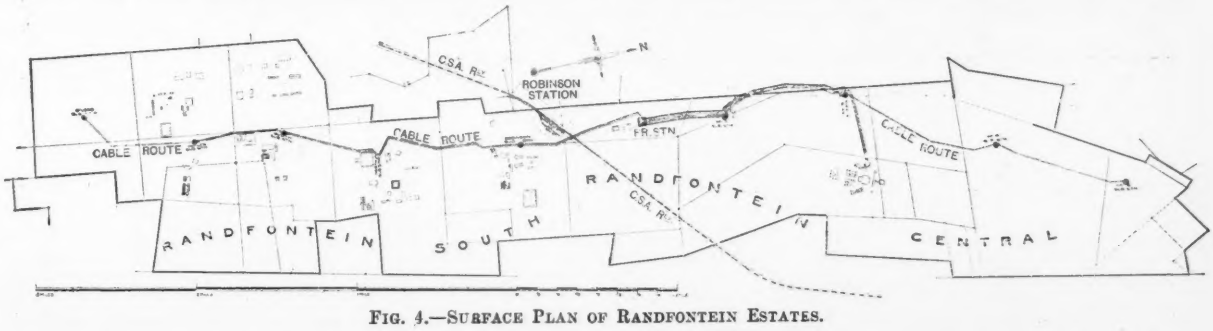


FIG. 4.—SURFACE PLAN OF RANDFONTEIN ESTATES.

FIG. 5.—GENERAL VIEW OF ENGINE ROOM.

The speed regulation and governing are effected by a master governor valve operated by oil pressure, which admits steam to the turbine sufficient for three-quarter load, after which the spindle of the master governor valve still travels further without admitting more steam through the main governing valve, and mechanically opens two auxiliary governing valves, for full load and load and a quarter respectively. A further hand-operated overload valve, for 50 per cent. overload, admits steam through the last three of the 16 steam ports; but it is unlikely that this will ever be required.

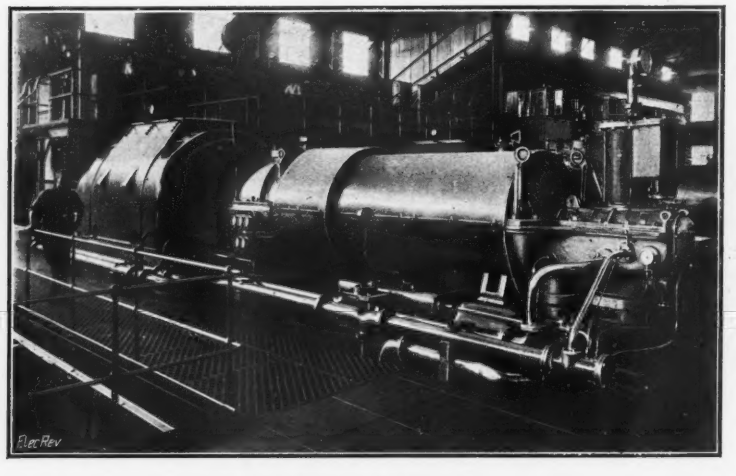


FIG. 6.—PARSONS 2,000-KW. SET.

Means are provided for controlling the speed electrically from the switchboard and for tripping an emergency run-away governor valve (actually the main stop valve), which also acts automatically at a speed of 15 per cent. above the normal.

Three current-limiting reactance coils are connected in the main circuit between the alternator and the bus-bars, the main switches being operated electrically by solenoids. There is an individual air-conditioning apparatus used in ventilating this machine. The alternator is totally enclosed, and is ventilated on full loads by an electrically-driven fan, which draws outside air through water-sprays that eliminate all dust, and admit of temperature regulation.

The complete unit (fig. 1), together with the condensing plant, reactance coils, and switchgear, &c., was supplied direct by the British Westinghouse Electrical and Manufacturing Co., Ltd., of Manchester, through their Johannesburg office.

The two 6,000-KW. Parsons turbines, a view of one of which is shown in fig. 2, are of the multiple reaction type, and are each coupled to a Parsons three-phase alternator.

Each of the turbines is provided with two cylinders in tandem, the L.P. cylinder constituting an exhaust-steam turbine, into which the exhaust from the H.P. cylinder enters, at about 14 lb. per sq. in. absolute. By this means the turbine spindles are reduced in length, and allow of a stiff, rigid construction, and four main bearings, instead of two.

The speed is governed by a standard Parsons centrifugal mechanical governor, rotating vertically on a spindle driven from the main shaft by worm gear. This governor, acting through a relay plunger valve, operates a main double-beat valve, which admits steam to the turbine in puffs—the duration, but not the rapidity, of which depends upon the generator load. When the turbine is working at its full load, or above it, the gusts of steam merge into a continuous blast, with the double-beat valve wide open, and stationary. An automatic overload valve is fitted, but the load on any alternator is never allowed to rise above the normal.

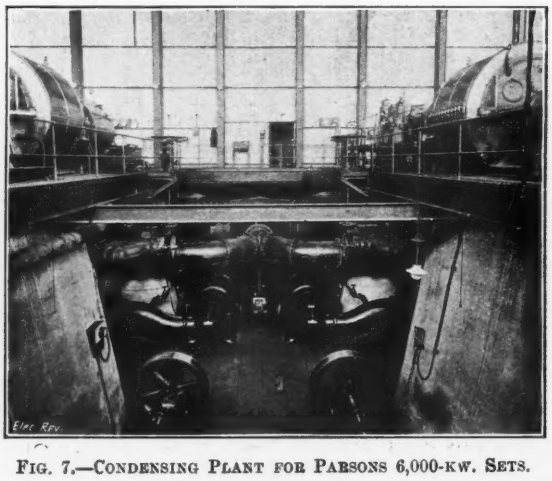


FIG. 7.—CONDENSING PLANT FOR PARSONS 6,000-KW. SETS.

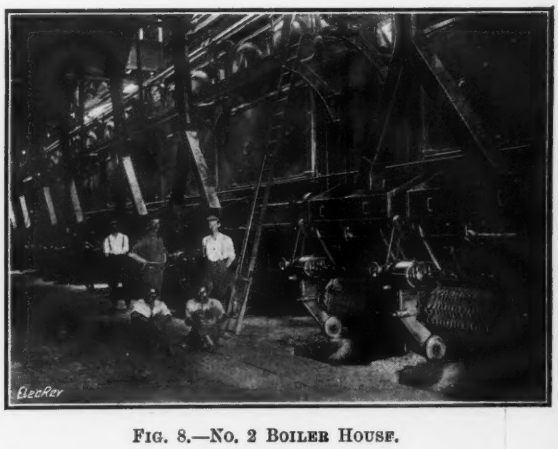


FIG. 8.—NO. 2 BOILER HOUSE.

A centrifugal emergency governor, working off the same spindle, and which in its operation entirely shuts the steam off the turbine, can be actuated either by the driver or from the switchboard, and is automatic on overspeeds relatively excessive.

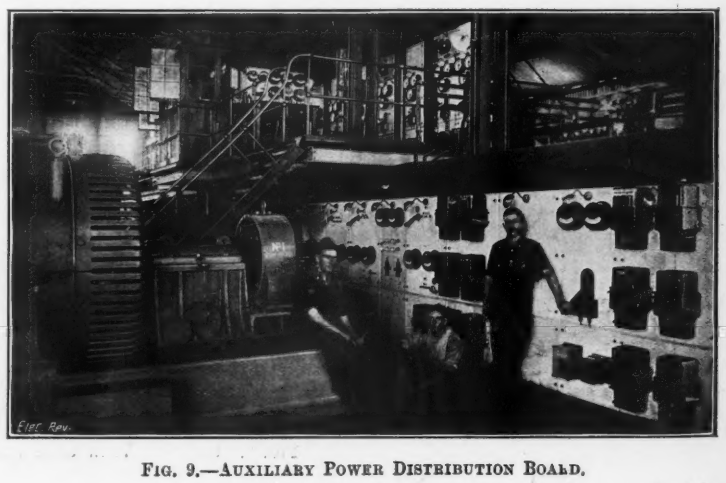


FIG. 9.—AUXILIARY POWER DISTRIBUTION BOARD.

The speed of these sets is 1,000 R.P.M., the alternators being of the totally enclosed self-ventilated type with individual exciters coupled to the ends of the shafts. There is a further arrangement for ventilating all machines—two "Sirocco" fans, electrically driven, being placed in a building adjoining the station, which drive cold air into the cable trenches and through the various alternator windings, discharging into the engine room through the tops of the alternator yokes. In this case care is taken to see that there is a modicum of water kept on the floor of the cable runs, otherwise trouble arises from dust.

(The two 6,000-KW. Parsons turbines are built to the same patterns as those at Lot's Road, and are in many ways similar, except that the Lot's Road turbines are driving Westinghouse alternators, and are set upon Westinghouse bed-plates, laid down by the present writer in 1903.)

Originally the bearing lubrication of these sets was carried out by individual oil pumps driven from the turbine shafts, but the plungers of these pumps have been removed and a gravity system adopted, with an auxiliary oil cooler as well as the two machine oil coolers. The oil after passing through the bearings gravitates into a tank placed in the condenser pit, and from that point is pumped into four tanks by an electrically-driven plunger pump. These tanks are shown just below the crane girder level in figs. 1 and 2. From the tanks, which are provided with an electrical tell-tale, the oil gravitates to the bearings, giving a constant pressure of 5 lb. even when the machine is stationary. A Worthington steam oil pump is used as a stand-by.

The 2,000-KW. Parsons turbines (fig. 6) are of the usual single cylinder construction, and offer no unusual features. These three machines, as well as the two small 1,000-KW. sets, each have an individual oil pump for lubricating purposes, a small hand pump being used on starting up.

Circulating water for condensing purposes is derived from an adjacent shaft, which is one of the wettest on the property. Three artificial cooling ponds have been constructed, a fourth reservoir being used as a settling dam. It was found that the settling-dam water was slightly acid, and it is treated by the addition of lime to neutralise this effect. The water passes from the settling dam into the first cooling pond through a motor-driven rotary pump.

The cooling system consists of one enclosed tower (shown in fig. 3), one open tower, and one open spray pond, the two former being situated at the east end of the station, and the latter at the west end. In addition to the usual spray troughs, in both the open and closed cooling towers, quantities of brushwood are placed in position below the troughs, which have the effect of disintegrating the falling water into spray, and adding to the cooling properties of the towers.

The condensers are all of the surface type; and all, except the Westinghouse condenser, are fitted with the Parsons vacuum augmentor.

The air pumps of the 1,000-KW. and 2,000-KW. sets are of the Parsons triple compound type. In the 1,000-KW. sets the air pumps and circulators are driven by one 60-H.P. induction motor, the circulators direct and the air pump through gearing. The pumps for the 2,000-KW. sets are driven separately, the air pumps by a 13-H.P. motor and the circulating pumps by 70-H.P. motors.

The Parsons 6,000-KW. sets each have an Edwards air pump and a Worthington circulating pump, the former driven by 20-H.P. Westinghouse motors and the latter by 200-H.P. Westinghouse motors (fig. 7).

The effective head that the circulators work against is 40 ft., the condenser discharge being led underground some distance from the generator house, in both directions, where it is raised to launders, leading to the towers, which may be operated in parallel, or singly, as may be desired.

The Edwards air pumps of the 6,000-KW. sets originally were equipped with a lift pump for handling the condensate, but, as mentioned previously, this is not utilised, the water gravitating into a hot-well, whence it is pumped by rotary pumps to the hot-feed tanks. Incidentally, it may be remarked that as this plant is somewhere about 6,000 ft. above sea level, the apparent vacua are affected accordingly (average barometer 24·5 in.).

(To be continued.)

NOTES.

Volunteer Notes.—ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS.—Headquarters, Marconi House, Strand, London, W.C. Company Orders by Lieut.-Colonel C. B. Clay, V.D., Commandant, for week ending July 24th, 1915:—

MONDAYS.—6.30 and 7.30. No. 1 Platoon, Technical Instruction and Squad Drill. No. 3 Squad, Squad Drill without arms. No. 4 Squad, Squad Drill with arms.

WEDNESDAY.—6.30 and 7.30. Platoon and Company Drill.

FRIDAY.—6.30 and 7.30. No. 1 Platoon, Technical Instruction and Squad Drill. No. 3 Squad, Squad Drill with arms. No. 4 Squad, Squad Drill without arms. Orderly Sergeant, Corbett, R. W. T. Recruit Orderlies, Squad 3, Spiers, S. V.; Squad 4, Foxton, J.

Munition Work.—Owing to shortage of material, it has been impossible to arrange work for Saturday, July 17th.

Camp at Thames Ditton.—The Architects will welcome any member of the E.I.V.T.C. who wishes to spend the week-end in camp. Names must be given to the undersigned by Wednesday morning, and members going to camp must take with them blankets, knife, fork, spoon, cup and soup-plate; expenses about 7s. 6d.

Punctuality on Parade.—Owing to the amount of time lost on falling-in on parade, members are reminded that drills commence at 6.30 and 7.30, and every man must be in position when the fall-in is sounded. Any member who is not present when his name is called will not count a drill for the hour for which he is late.

E. G. FLEMING,
Company Commander and Acting Adjutant.

3RD BATT. (OLD BOYS) CENTRAL LONDON REGIMENT (VOLUNTEERS).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, July 15th, 1915:—*Week-end Parades.*—Saturday: Afternoon operations. The Battalion will parade at Baker Street Station at 2.30 p.m., and proceed as follows:—The right-halt Battalion will detrain at Harrow, the left-half Battalion will detrain at Preston Road. Both forces will be told off into small Patrols under the command of N.C.O.'s. Officers will act as umpires. The Preston Road Force will watch the approaches from Harrow, working along the cross roads of East Lane and Preston Lane; from the latter point, northwards along the Preston Lane to Preston and the N.E (north-east) along the lane leading to the road from Kenton to Kingsbury Green. They are not to go west of this line. The Harrow Force will reconnoitre towards Forty Farm, Uxendon Farm, Preston and Kingsbury Green, and will endeavour to break through the opposing line of Patrols on the Preston Lane line, and reach Camp.

Bounds.—North—Road from Harrow to Kingsbury Green *via* Kenton. *South.*—East Lane to Forty Farm, and Camp.

Sunday.—6 a.m.—Reveille; 7 a.m., Sergeant-Major's Parade under the supervision of Mr. F. H. Stevens; 10 a.m., Church Parade; 10.20 a.m., Company and Platoon Drill: 2.30 p.m., Battalion Parade.

ADVANCE PARTY.—It is proposed to send an Advance Party of one officer and 25 men to Ongar to get the Camp ready for the Corps. N.C.O.'s and men desirous of volunteering for this duty, are requested to send in their names to their Company Commanders, who will forward them to Headquarters as soon as possible.

A. G. JOINER, *Captain and Adjutant.*

Batteries for Egypt.—We have received a letter from a correspondent in Egypt in which he asks us to draw the attention of British storage battery makers to the excellent opening that exists there now for their manufactures, the business having been previously almost entirely in the hands of Germans. The writer says that any company choosing to start such a business should have an efficient inspector living in the country, preferably in Cairo, and he would have to know some other language (preferably French) besides English. The German firms paid their representative a good salary and commission. Our correspondent is willing to furnish further information to any firm who cares to communicate with him through us.

Foreign Trade.—THE JUNE FIGURES.—The following are the electrical and machinery figures given in the official returns for June:—

	Month of June.		*Inc. or dec.*	*Six months, 1915.*		*Inc. or dec.*
IMPORTS.						
Electrical goods and apparatus, excluding machinery and uninsulated wire	£ 83,908	−	£ 40,493	£ 455,208	−	£ 349,437
Machinery ...	923,670	+	234,611	4,377,390	+	233,046
EXPORTS.						
Electrical goods and apparatus, excluding machinery and uninsulated wire	293,806	+	22,526	1,486,998	−	217,231
Machinery ...	1,856,202	−	1,242,180	9,800,741	−	9,668,814

Institution and Lecture Notes.—Physical Society of London.—At the meeting held on June 25th, a paper, entitled "Conduction of Electricity Through Metals," was read by the president, Sir J. J. Thomson. The discovery by Kamerlingh Onnes, that at the temperature of liquid helium some metals can exist in a state in which their specific resistance is less than one hundred thousand millionth part of that at 0° C., appears to necessitate the abandonment of the ordinary theory of metallic conduction, as the experimental conditions prohibit the explanation of the phenomenon by an abnormal increase either in the number or mean free path of the free electrons. The effects observed by Kamerlingh Onnes may, however, be accounted for by a theory of metallic conduction previously given by the author in "The Corpuscular Theory of Matter," and explained in the paper.

A paper "On an Unbroken Alternating Current for Cable Telegraphy" was read by Lieut.-Col. G. O. Squier, Ph.D. The paper proposed a new angle of view in the method of transmission of signals in the submarine telegraph cable, and described some apparatus for operating on the general principles involved. An ocean cable was considered as a power line, and starting with the standard form of circuit which would be used in case it were required to operate an electric motor through an ocean cable, experiments were described to determine the minimum possible variations required in such a circuit to permit the alternating current received to be interpreted in dots, dashes and spaces of the present alphabet. The uninterrupted alternating current used in transmission was operated on synchronously by the ordinary transmitting tape, so as to alter the impedance of the transmitting circuit at the instants when the current was naturally zero. Dots, dashes and spaces were each sent by semi-waves of either sign, but of different amplitudes. The alternating current received might be read directly from the record made by a siphon recorder, or this current might be employed to operate a siphon Morse printer, by means of an adaptation of Muirhead's gold-wire relay, or a Heurtley magnifier and a local wire relay. A special form of cable dynamo to operate at frequencies from 4 to 10 was used in the experiments described. The fundamental principle was developed of never metallically "breaking" the transmitter circuit, which permitted of greater accuracy in balancing the duplex bridge.

The Council has decided to sanction and adopt the letters F.P.S.L. as the official indication of Fellowship of the Society. The Council has appointed a Committee to consider any scientific suggestions or inventions which Fellows of the Society may care to bring before it in connection with the war.

Illuminating Engineering Society (U.S.A.).—At a recent meeting Dr. C. P.Steinmetz was elected president of the Society.

Royal Institution of Great Britain.—The following resolutions were unanimously passed at a recent meeting of the members of the Royal Institution:—(1) That the Royal Institution is desirous, as it always has been, of rendering to His Majesty's Government in relation to the war every assistance which lies within its objects as defined and governed by the Charter and Act of Parliament governing the Royal Institution, and by the conveyance and deed of trust of the Davy Faraday Research Laboratory. (2) That with a view to giving effect to this desire letters be addressed to the First Lord of the Admiralty, the Minister for War, the Minister of Munitions, and the Chairman of the Inventions Board of the Admiralty, requesting them to communicate with the managers, in case there is any field of research in relation to or connected with chemical and physical science, or either of them, to which the professors, assistants, and staff of the Royal Institution, or of the Laboratory, can usefully direct their attention, with a view to giving assistance to His Majesty's Government in the conduct of the war, or in case they desire that any members of their respective staffs shall be admitted to work in the Laboratory in the prosecution of any such research.

Patents and Alien Enemies.—Applications have been made to the Board of Trade for the avoidance or suspension of the following patents:—Nos. 8,487/06 and 30,101/10, granted to Rogler and Hoerbiger, by the Lilleshall Co., Ltd., Messrs. John Musgrave & Sons (1913), Ltd., and Messrs. Bellis & Morcom, Ltd.

Standardisation of B.A. Screws.—The standardisation of B.A. screws, taps and dies, and gauges has been before the Small Screws Sub-Committee of the Engineering Standards Committee for some time; on account mainly of the difficulty of finding satisfactory methods for the standardisation of the small screws and gauges, no definite decisions have been formed, but certain provisional conclusions have been reached which have enabled the National Physical Laboratory to issue a tentative list of dimensions which, there is reason to believe, may at the present juncture be of service to persons using the screws and assist in obtaining interchangeable work. The scheme is embodied in a number of tables intended to secure a fairly easy fit; for some purposes it might be necessary to reduce somewhat the limits given, and the tables are accompanied by notes regarding the permissible variations. The question of gauging has also been considered, and tables for the sizes of gauges are given. Particulars can be obtained from the National Physical Laboratory, Teddington, which is prepared in the interim to certify screws, &c., which fall within the prescribed limits as B.A. screws, taps or gauges.

Appointments Vacant.—Two switchboard attendants, for the Cleckheaton D.C. electricity works. See our advertisement pages to-day.

Inquiries.—Makers of a machine for compressing the graphite-manganese cylinders for dry cells are asked for.

Electrical Contractors' Association of Scotland.—At the annual meeting of the Glasgow Branch of the Association on Thursday last week, the chairman said that during the year there had been a net increase of seven members to the Branch.

Over a year ago the Committee received a deputation from the Electricity Committee of the Corporation, which was instructed to see what arrangements could be come to in order to have a first-class electrical showroom for Glasgow. The deputation wished first of all to give the E.C.A. the opportunity of opening and carrying on this showroom, but the Committee did not consider a showroom either a necessity or a profitable thing for either party to run. The representatives of the Corporation stated, however, that a showroom must be opened, and after many meetings it was arranged that the showroom should be opened and run by the Corporation.

The principal points arranged were:—The showroom should exist primarily for exhibition of electrical appliances; if a sale was made it would be at the usual trade retail selling price; all work resulting from inquiries at the showroom would be done direct by a contractor, and there would be no hiring. The agreement was for a first period of five years.

He had seen it stated that the conditions agreed to were less favourable to the Association than the I.M.E.A. Bill proposed. He thought any contractor reading the two sets of proposals would have no difficulty in seeing that in their case they were protected from rate-aided cutting with its attendant inferior workmanship, whereas in the I.M.E.A. proposals their trade would have been cut away from them to be run at a loss by a municipal "Kaiser." Another thing was that they knew Mr. Lackie and what he intended to do with the showroom.

Some time ago the wrights and masons had a difference of opinion with the architects and measurers regarding conditions and form of contract, and Sir G. Askwith was asked to arbitrate on the questions raised. The Association's representatives had attended a number of meetings regarding this. Up till now a measurers' schedule had been a schedule of rates. The new proposal was that they should have a contract total price accepted, not a schedule of rates, and any alterations beyond a small margin to be a mutual arrangement between architect and contractor. A complete set of conditions and rules of contract was being arranged, and later a model form of schedule would be drawn up for use by the measurers.

The Association had had proposals for agreements between the E.C.A. of Scotland and the Dynamo and Motor Manufacturers and also the Tungsten Lamp Association. They were not satisfied in either case with the inducements offered to them.

The Committee had now started to consider the question of rules for apprentices, and a draft set of rules had been drawn up.

They had given the men an extra 1d. per hour war bonus under their agreement with the engineers and shipbuilders. A slight alteration had been made in the rules for workmen in a friendly spirit on both sides.

The Association, as a whole, was now on a firm basis both as regarded membership and finance.

Australian Railways.—The *Sydney Daily Telegraph* states that the Minister for Railways has in preparation an amendment of the Railways Act. This, in addition to giving the Government power to initiate a policy in regard to railway matters, also provides for the appointment of five Railway Commissioners. The railway administration will be divided into four departments—electrical, locomotive, existing lines, and traffic. In charge of each will be a sectional commissioner, while the fifth will act as chief, supervising the work of his colleagues.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. E. J. COCHRANE, assistant electrical engineer to the Sydney, N.S.W., City Council, has, according to *Tenders*, been appointed general manager and chief engineer to the City Electric Light Co., of Brisbane. Mr. Cochrane will take up his new duties in August.

MR. SEABROOK, the general manager of the Marylebone electricity undertaking, has been asked to act as chairman of an operating Sub-Committee of the Metropolitan Munitions Committee, and also to act as district supervisor of various works.

The Gillingham (Kent) T.C. has granted MR. G. SAMPSON, assistant meter reader at the electricity works, permission to join the Forces for the period of the war. Similar permission has also been given to MR. P. LINES, of the electricity works staff.

The Dartford U.D.C. has increased the salary of MR. R. JONES, assistant electrical engineer, from £150 to £160 per annum. The Committee recommended three yearly increments of £10 each, but the question of future increments has been deferred pending the receipt of a report on the wages of employés in the department.

With reference to the third item appearing in this section last week, we regret to learn that the information there given was not quite accurate. The announcement should read as follows:—MR F. WHITEHEAD, charge engineer on the gas plant at the

Accrington Corporation electricity works, has resigned, and MR. A. GOWARD, shift engineer, has been appointed to fill the vacancy. Mr. Goward was appointed shift engineer in November, 1912.

MR. W. B. CHILD, assistant electrical engineer to the Leek U.D.C., has resigned, having obtained another appointment.

MR. W. E. LLOYD, secretary and manager of the municipal electricity works at Bacup, has resigned.

Among the members of the Hammersmith B.C. electricity department staff who have taken up duties under the Crown since the commencement of hostilities are the following from the official staff:—A. T. GORDON SMITH, sergeant-major, Hon. Artillery Company; T. H. MEACOCK, sergeant, 13th County of London Regiment; H. R. WATTS, private, Hon. Artillery Company; J. E. PEARCE, sergeant, London Electrical Engineers; W. J. WHYMAN, private, 13th County of London Regiment; P. C. G. SLY, private, 4th Grenadier Guards.

MR. C. H. THORPE, engineer-in-charge of the Hammersmith B.C. electricity works, has resigned his appointment.

MR. W. E. CLARET, the works superintendent of the Maidenhead Corporation electricity works and late chief assistant engineer of the Smithfield Markets Electric Supply Co., Ltd., has been appointed chief engineer to the Hale End works of the British Xylonite Co., Ltd.

SAPPER A. DUNCAN, who has been employed in the Harrogate Corporation electricity department for 14 years, latterly in charge of the meter and test-room department, is now serving in the London Electrical Engineers unit.

At a meeting of the Farnworth Council on July 6th, the chairman of the Electricity Committee reported that the electrical engineer, MR. A. J. HUTCHINSON, had an opportunity of accepting a commission with the Royal Engineers, and was wishful to do so. The Council gave full consideration to the matter, and, in view of the depleted staff, it was resolved to request Mr. Hutchinson "to continue his duties here, as he is serving his country in a useful capacity in the performance of his present duties."

Tramway Officials.—The Wolverhampton T.C. has been asked to grant an honorarium of £50 to MR. C. OWEN SILVERS (the deputy tramway manager), in recognition of the extra services rendered by him in connection with the laying of the double track in Bilston Road, and also for the increased responsibility which has fallen upon him consequent upon the absence of the tramway manager (Mr. W. A. Luntley) through illness.

The Colchester T.C. has voted a gratuity of £25 to MR. R. C. BULLOUGH, tramway manager, on account of greatly increased responsibility and work since the outbreak of war.

General.—At the last meeting of the Technical Education Sub-Committee of the Bradford City Council, it was reported that the External Examiner in Electrical Engineering was unable to act during the present year, and it was resolved that MR. P. J. PYBUS, M.I.E.E., be invited to act in his place.

The engineer engaged at the power station of the Bradford Technical College having obtained a commission in the Mechanical Transport Section of the Army Service Corps, has been granted the necessary leave of absence, and MR. R. H. HARROP has been appointed as acting station engineer.

MR. A. G. ELLIS, A.C.G.I., who for the past two years has been with Messrs. Brown, Boveri & Co., in Baden, Switzerland, and is now vice-chief of the transformer department, was married on June 7th to Miss E. H. Price, at St. Leonard's Church, Hythe. From a letter which we have received from him, we learn that the war has exercised very little effect on things in Switzerland, although that country is ringed round with fighting nations; at the works they are "quite busy."

The following announcements appear in the *London Gazette*:—

Territorial Force.—*Royal Engineers:* London Electrical Engineers.—THOMAS CLIFFORD MANN to be Second Lieutenant.

Tyne Electrical Engineers.—NOEL GORDON HOLLEBONE to be Second Lieutenant.

The staff of Messrs. Crompton & Co., Ltd., Chelmsford, have presented a case of cutlery to MR. FRANK HARVEY, on his marriage. Mr. Harvey has been with the firm for nearly 14 years.

The marriage took place at Fetteresso Church, on June 30th, of MR. HUBERT WM. DRURY, electrician, of Torquay, and Miss Margaret McLennan, second daughter of Mr. Geo. McLennan, of Fetteresso, Stonehaven.

MR. E. E. STOCKENS, from Aberdeen, has this week taken up the position of manager of the Blackburn telephone service in succession to Mr. Barnes.

The local Munitions Committee formed for Blackburn and District includes MR. P. P. WHEELWRIGHT, borough electrical engineer of Blackburn.

MR. SPENCER HAWES, M.I.E.E., has been appointed managing director of the Reading Electric Supply Co., Ltd. Mr. E. Rowley Hill retired from the post of engineer and manager at the end of June last.

MR. A. R. COURTENAY (late acting manager of the G.E.C. publication department) was gazetted on May 20th Sub-Lieutenant in the Royal Naval Air Service, Armoured Car Aeroplane Support (Royal Naval Volunteer Reserve), and is now undergoing a course of gunnery.

Roll of Honour.—Private A. G. BELL, of the 1st Northants, who was meter reader at the Kettering U.D.C. electricity works, has been killed in action in Flanders. Private WM. MACE, of the 2nd Northants, who was arc lamp trimmer at Kettering, has lost his right arm and also had his jaw fractured, while fighting in Flanders. Another member of the Kettering staff, Private G. MUNDEN, of the 2nd Duke of Cornwall's Light Infantry, jointer's mate, has been home suffering from frostbitten feet.

Corporal JOHN WILSON, of the London Scottish, who has been killed in France through the bursting of a bomb he was in the act of throwing, was assistant secretary to Messrs. Balfour, Beatty and Co., Ltd., electrical engineers.

Private GEO. VIVIAN ASH, of the 15th Lancs. Fusiliers, who was chief clerk in the Bury (Lancs.) Corporation tramways office, has been killed in action.

Sergeant HARVEY ANDREWS, 8th Lancs. Fusiliers, who has been killed in action in the Dardanelles, was, until the outbreak of war, switchboard attendant at the Salford Electricity Works in Frederick Street. He had served four years in the Territorials, and was in his 20th year.

Private GEORGE B. WILSON, of the 4th East Lancashire Regiment, an engine driver at Darwen electricity works, has been wounded.

Private L. EDWARDS, formerly employed by Messrs. C. Macintosh and Co., Ltd., Manchester, has been killed in action.

Sapper ARTHUR HAYDOCK OGDEN, B.Sc.Tech., who has died from wounds received in the fighting at the Dardanelles, was 26 years old, and was in the employ of the Lancashire Dynamo Co., at Trafford Park. He was educated at Sale High School, Rossall School, and the Manchester University.

Private J. ORRELL, 18, an employé at the Westinghouse Works, Trafford Park, has been killed in action.

A member of the staff of the Ilford Urban District Council's electricity department (he was engaged in the inquiry office) has been granted the D.C.M. whilst on active service in France. We refer to 2,159 F. J. BURKE, Signal Section "B" Company, 6th Battalion London Regiment, 47th division. The circumstances are related as follows, in a letter from Rifleman A. Homewood, dated July 10th:—

> Our brigade took part in a recent big battle in which it suffered heavy losses, and during a heavy bombardment by the Germans our communication wires got broken. Two men—Riflemen Layton and Rifleman Lambert—set out to mend these wires, but, sad to say, they never returned. The bombardment was growing more severe when Rifleman Burke, of the Signallers, volunteered to run a wire from the firing line to headquarters. This seemed almost certain death, as the road which he was to take was nothing more than a death trap. The road (Willow Road) was being heavily shelled when he set out, but somehow he managed to get the wire through this "hell of fire," for which he has just been awarded a well-deserved D.C.M.

In a letter dated July 7th, Rifleman BURKE gives, in reply to a request, the following fuller particulars:—

> We were at a place on the line—I'm afraid I cannot mention the name; but they were not trenches, the front line was composed of a breastwork of sandbags, which we had to approach across open country up a road, part of the way. There was a village about halfway between headquarters and the firing line, and I was responsible for the upkeep of the telephone lines. I had two linesmen at the village and one in the breastwork. We had a station at the village and two in the front line. About 6 o'clock on Whit Saturday morning they started shelling headquarters and gradually worked their way up to the village. About 6.30 our Signal Sergeant came to me and said all communications were broken between the village and the front line, although we had double wires the whole way. He said the two men had gone out from the village, but he was anxious to get communication, so asked me to go up and see about it. I went up the line and when I got to the village I had to take cover for over two hours before I could cross a road to the signal station. I got across at last and found they had not yet got into communication, and the other two fellows had not returned. I started out to follow the wires, which ran one on each side of a road up to the breastwork, but they were shelling the road so heavily that it was impossible to get near it, so I went back to the station, and they said the only thing to be done was to run a new wire, so a lance-corporal and myself took out a reel of wire and ran like the devil across the open country on the left of the road. We had to drop flat several times when shells dropped much too close to be pleasant; we had to stop for a breather half way in an old trench. We eventually got to the signalling dugout and connected up, thus getting into communication; then we had to run all the way back. Nearly all the men we saw were wounded, and the sights we saw that day were enough to make one sick of war for ever. The distance we ran the wire was about 600 yards. Luckily, the wire lasted through the bombardment, which did not cease until after 3 o'clock that afternoon. We got a chance a few days afterwards to put the original wires in working order. . . . I might say the two fellows who went out to mend the wire did not return, but we found them the following day; they had been killed by a shell.

Second-Lieutenant THEODORE E. WILLIAMS, who for some six years was on the staff of the Hendon Electric Supply Co., Ltd., at Golder's Green, has fallen whilst fighting in Belgium. He was killed at Ypres on the 1st inst. He received his commission in the 1st Somerset Light Infantry only a few weeks ago. He was originally attached to the Artists' Rifles.

The Marylebone electricity department has received information that the following members of its staff are wounded:—GREGORY, W., 1st East Surrey Regiment; HIGGINS, W., 3rd Middlesex Regiment; GAMBLE, A., 1st King's Royal Rifles; WARD, C., 1st London Regiment. SNOW, A. J., 13th London Regiment, is a prisoner of war in Germany; and GILL, G., 10th Middlesex Regiment, has been discharged, medically unfit from accident.

Lieut. W. J. C. BUDD, 2nd South Wales Borderers, who was killed at the Dardanelles on June 28th, was chief clerk in the Shanghai municipal electricity department from 1904 onwards. He received his commission in Shanghai in December last. He went from England to the Dardanelles on June 10th. He was 39 years of age.

Sub-Lieut. J. A. E. TREMAYNE, R.N.V.R., who was killed at the Dardanelles on June 19th, served his apprenticeship at Messrs. W. H. Allen's works at Bedford.

Obituary.—MR. E. R. CALLENDER.—The death occurred at Warren Cottage, near Dawlish (Devon), on Sunday, of Mr. Ernest R. Callender, who was an electrical engineer on the Manchester Ship Canal.

NEW COMPANIES REGISTERED.

F. Husband, Ltd. (140,919).—This company was registered on July 8th, with a capital of £1,000 in 10s. shares (1,000 7 per cent. pref.), to acquire the business connection of an electrical engineer belonging to F. Husband, and the benefit of his British patent rights in connection therewith. The subscribers (with one pref. share each) are: S. E. Pinney, 13, Thorpe Road, Amhurst Park, N., clerk; J. A. Fraser, Rutland House, Southend Road, Beckenham, Kent, solicitor; M. Lawrence, 22, Eastfields Road, Acton, W., clerk. Private company. The number of directors is not to be less than two or more than three; the first are F. Husband and J. A. Fraser. Remuneration £105 per annum divided between them. Registered office: Craven House, Kingsway, W.C.

J. Farr and Co., Ltd. (140,905).—This company was registered on July 7th with a capital of £1,500 in £1 shares, to adopt an agreement with J. Farr, trading as J. Farr & Co., for the purchase of the business of an electrical engineer and dealer in electrical goods of all kinds carried on by him at Upper Parliament Street, Nottingham. The subscribers (with one share each) are: Mrs. M. A. Farr, Carisbrooke Drive, Nottingham; P. J. Smith, St. Peter's Chambers, Nottingham, solicitor. Private company. The number of directors is not to be less than two or more than five; the first are J. Farr (governing director, subject to holding 1,000 shares) and Mrs. M. A. Farr (both permanent). Remuneration of J. Farr as governing director £250 per annum; of other directors as fixed by the company. Solicitor: P. J. Smith, St. Peter's Chambers, Nottingham. Secretary: H. Onion, 81, Beech Avenue, Nottingham.

Birmingham Central Supply Co., Ltd. (140,884).—This company was registered on July 6th, with a capital of £2,000 in £1 shares, to take over the business carried on by W. Parsons and Mrs. R. E. Parsons at 84a, Tilton Road, Small Heath, Birmingham, Warwick, as the Central Supply Co., and to carry on at Birmingham and/or elsewhere the business of engineers, manufacturers of and dealers in electrical apparatus, equipment, machinery and appliances, and gas and electric fittings, hardware, and machinery of all kinds, magnetic, telegraphic, telephonic, chemical, scientific, and other appliances and apparatus, implements, goods, wares, and products, refiners of and dealers in illuminating, lubricating, fuel and other oils, etc. The subscribers (with one share each) are: W. Parsons, Oriel, Warwick Road, Olton, Birmingham, merchant; Mrs. R. E. Parsons, Oriel, Warwick Road, Olton, Birmingham. Private company. The number of directors is not to be more than five. W. Parsons is sole permanent director and chairman. Solicitor: G. Williams, Bank Buildings, Cradley Heath, Staffs.

Wholesale Electrical Co., Ltd. (140,845).—This company was registered on July 1st, with a capital of £2,000 in £1 shares (1,000 pref.), to take over the business of manufacturers of and dealers in electrical supplies carried on at 54 & 56, Oxford Street, W., as the Wholesale Electrical Co., and to adopt an agreement with T. W. Greaves. The subscribers (with one share each) are: T. W. Greaves, 54-56, Oxford Street, W., electrical engineer; F. W. Evans, 140, Copleston Road, East Dulwich, S.E., electrical sales manager. Private company. The first directors (to number not less than two or more than three) are T. W. Greaves and F. W. Evans (both permanent). E. H. Bevnes may retain office as secretary while holding 200 shares. Qualification, £200. Remuneration, £5 per annum. Solicitors: Crawford, Ely and Co., 45, Great Marlborough Street, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Altrincham Electric Supply, Ltd. (40,795).—Issue, on July 5th, 1915, of £1,800 debentures, part of a series of which particulars have already been filed.

New System Private Telephone Co., Ltd. (73,732).—Capital, £10,000 in £1 shares. Return dated June 15th, 1915. All shares taken up; £8,000 paid; £2,000 considered as paid. Mortgages and charges: Nil.

Standard Electric Co., Ltd. (68,643).—Capital, £10,000 in £1 shares (5,000 pref.). Return dated May 26th, 1915. 3,077 pref. and 5,000 ord. shares taken up; £1 per share called up on 4,177 ord. and 10s. per share on 400 pref.; £4,377 paid; £3,700 considered as paid, being £1 per share on 823 ord. and 2,677 pref., and 10s. per share on 400 pref. shares. Mortgages and charges: £3,500.

Phillips Commutator Grinder Co., Ltd. (94,544).—Capital, £25,000 in £1 shares. Return dated June 23rd, 1914 (filed April 8th, 1915). 5,452 shares taken up; £1 per share called up on 3,602; £3,603 3s. paid (including £1 3s. paid on 105 shares forfeited); £1,850 considered as paid on 1,850 shares. Mortgages and charges: £550.

CITY NOTES.

Electric Light and Power Supply Corporation (Sydney).

THE report for the half-year ended April 30th shows further expansion in business and increased profit. It is difficult to make any fair comparison of the accounts, as the dates of closing them have been altered, but the directors give the following statement:—

	Half-year to June, 1914.	Half-year to April, 1915.
Consumers	2,353	2,911
Revenue	£17,957	£21,448
Expenses	8,348	9,149
Net profit	9,609	12,299
Brought forward	2,680	3,158
Available	£12,289	£15,457

After deducting debenture interest, dividends at 7 per cent. per annum were paid on the share capital, and appropriations were made for depreciation and other purposes. The £15,457 above is absorbed by debenture interest, £3,473; dividend, £4,409; reserve for depreciation of assets, £5,300; and debentures flotation expenses, £702; leaving £1,573 to be carried forward. The share capital is £125,980, and debentures £100,300. In June last year the share capital was £51,280, and debentures £175,000. The second debentures are in process of conversion into shares. The registered office is to be altered to Margaret Street, Rozelle.

General Electric Co., Ltd.

THE annual meeting was held on Friday last at the Cannon Street Hotel, E.C. Mr. H. HIRST said that every abnormal movement noticeable in the country since the outbreak of the war had recorded its imprint on the company, and a summary of their experiences, arranged chronologically, might be of interest. On August 3rd, Bank Holiday—on the eve of the war—the Government desired prompt execution of emergency orders, and for this the immediate return of the staff to certain works was essential. It was a matter of pride to them, and also reflected great credit on their workpeople, that in spite of its being holiday week, over 99 per cent. turned up to give them the best of their work. The few days of financial unsettlement which followed the outbreak of hostilities did not seem to materially affect the electrical industry; whilst the month of August, which with them was generally the quietest month of the year, became one of the busiest. It appeared that factors and the trade, fearing a shortage of supplies, decided to fill up their stocks and, consequently, indulged in over-buying. The reduction of their stock as compared with last year, was largely due to this policy on the part of the trade, and owing to their reduction of output in consequence of the shrinkage of labour, and lack of raw material, they had not as yet been able to sufficiently replenish it. Their considerable export business was partially checked owing to difficulties of freight and insurance, and also by their desire to safeguard the supplies for the home market. Early in September they suffered severely by well-meant, but ill-conceived, Press attacks on the Osram Lamp Works, Ltd., with which they were so intimately associated, owing to the prevalence in that company of German capital. The Press did not then sufficiently distinguish between German-owned trading concerns and factories established in this country which were useful and essential to national purposes. The importance of the Hammersmith works, not only to them but also to the Government and the country, was very great, and it was, therefore, exceedingly gratifying to him to announce that a way had been found, with the knowledge of the Treasury and the Public Trustee, which would give the future control of these works, he trusted for ever, into British hands. By the end of September or the beginning of October they felt the first effects of the depletion of their staff and workpeople. A great many of their employés enlisted on the declaration of war, and it required no recruiting officers at their works to encourage young men to join the Colours; about 1,000 of them were now serving with His Majesty's Forces. On the declaration of war three of the sons of the late Chairman, Mr. G. Byng, enlisted. One of them—Mr. Harry Byng—a man trained as an engineer, winning honours at Harrow, Faraday House, and Harvard University, he was sorry to say had since fallen in action in Flanders whilst leading his platoon to attack. Of their men, 11 had already laid down their lives, 50 were invalided, wounded, or missing. Thirty-one had obtained commissions, amongst whom were Mr. Leonard Byng, a director of the company, and also his (the Chairman's) only son. They all readily volunteered to leave the works they loved in order to offer their all to that greater cause which had absorbed our thoughts unceasingly for eleven months, and he feared would occupy them for as many months to come, or even longer. They had arranged to keep open all the positions of those who had enlisted, and to pay 50 per cent. of the salary to the dependents of all married men, to make special allowances to a certain number of unmarried men who had relatives dependent upon them, and to set aside 10 per cent. of the salary of all unmarried men other than above, so that they might have some cash reserve on their return to civil life. It was not until the end of October that they realised what great quantities of their normal productions were required for war purposes. It was a matter of great satisfaction to the board that their determination to maintain single-handed certain industries for patriotic reasons had at last been rewarded by the knowledge that they had proved not only of indispensable service, but of vital importance to the welfare of the country. The time was not yet opportune to make a statement of recent developments referring to this subject, but whenever that moment arrived it would be a fine page in the history of their company and a lesson, he trusted, to the country at large. The company was, fortunately, in so strong a position, that should there be in the immediate future, owing to exceptional circumstances, a reduction of profits, they would quickly be able to make good, after victory had been achieved, when those markets which were now being starved called for replenishments from British works. In order to cope efficiently with the increased work created by the growth of the business, it had been found necessary to add to the number of the directors. They had selected from among the staff Mr. James Young Fletcher, who had been with the company for over twenty years, and had graduated from the ranks to the position of branch manager, and subsequently manager of the Osram lamp business; Mr. Sidney D. White, who had grown up with the company since its inception, and who was in charge of all the Government work carried on by the company; and Mr. George Maurice, who was head of their fix-

ture business, also a servant of the company of over twenty years' standing, and fully conversant with their intricate and detailed business. They would be asked to confirm the election of Mr. Fletcher and White, but he was sorry to say it would not be possible to confirm that of Mr. Maurice. At his own suggestion, he decided on a trip to America in the month of March in order to open up business connections, principally for the purchase of raw materials which were unobtainable elsewhere. He was most successful, but, unfortunately, fell a victim to the murderous *Lusitania* crime. His loss would be deeply felt by them all, and the blank caused in their organisation would be very difficult to fill. With regard to the accounts, although the year showed a progress in profits, the absorption of some £22,000 extra for dividends owing to the increase of capital, had somewhat affected certain other items in the appropriation. The Pirelli-General Cable Works were completed and had started manufacturing for certain Government contracts, but owing to conditions of labour it might be quite some time before those works could be considered as being in full swing. Their Kingsway building was conceived to increase the efficiency of their administration, as well as to give greater comfort and better service to their customers. It seemed to them wrong at this juncture to pursue any scheme which did not add to national production or efficiency, and for this reason they had suspended building operations for the moment, and, as the removal, in consequence, would be deferred, they had only placed a very small sum this year to the account for provision for removal. The state of their finances had enabled them to invest £100,000 in the first War Loan, and shareholders might be interested to learn that they had since converted that into new War Loan, and had, in addition, applied for a further £100,000 of the latter, making up their total holding to £200,000. They were justified in hoping that they would be able to hold the bulk of this stock for a number of years; some £40,000 or £50,000, however, would eventually be absorbed by their allied enterprises, and by management, staff and workpeople, to whom they had given special facilities for gradual acquisition.

Mr. E. G. BYNG seconded the motion, which was carried unanimously.

The dividend resolution was passed, and the retiring directors were re-elected. A vote of thanks and appreciation was accorded to the board and staff.

Marconi International Marine Communication Co., Ltd.

MR. GODFREY ISAACS (managing director), presiding at the annual meeting, held at the Hotel Metropole on July 7th, expressed regret that Mr. Marconi was unable to be present owing to his having joined the engineering staff of the Italian Army to superintend the organisation of its wireless communication. With regard to the balance sheet, on the debit side the debentures were reduced from 6,250 to 6,094, representing £121,880 instead of £125,000. The amount appearing to creditors was some eight to nine thousand pounds in excess of the figure of the preceding year, accounted for merely by the normal increase of business. On the credit side the plant, apparatus, furniture, and stores showed an increase of between £39,000 and £40,000, due to the additional number of telegraph stations installed on board ships during the year, after making the customary substantial allowance for depreciation upon all installations fitted in previous years. The debtor balance showed an increase of some £13,000 to £14,000 consistently with the growth of the business. In consequence of the bigger business, expenses and salaries showed an increase, but these figures had not increased in the same ratio as the increase of business. Whilst each new installation entailed additional salaries to operators, the establishment costs of the complete world-wide organisation increased but slightly. The revenue showed an increase of between £28,000 and £29,000. In consequence of the outbreak of war, the receipts from ships' telegrams and news services during the last five months of the year suffered very materially. In the circumstances, and bearing in mind that theirs was not the nature of business which derived any advantage in consequence of the war, the result of the year's operations was the more satisfactory. It showed a continuous development year by year of a sound and growing organisation. The net profit for the year of £55,668, after deducting £28,000 for depreciation and debenture interest, was highly satisfactory. Some loss had been sustained in consequence of the destruction of ships by enemy submarines, and, having regard to the fact that this method of warfare continued, the directors had thought it desirable to place £10,000 to a special reserve account to provide for any eventualities, as being the prudent course, although they contemplated that compensation would be received. An amount of £20,747 was recommended to be carried forward in order that the company should have at its disposal ample cash resources. Every week they were adding new installations entailing additional capital expenditure, but adding steadily to the growth of their revenue. The CHAIRMAN referred with regret to the deaths of General Albert Thys, of Brussels, and Major Samuel Flood Page, both of whom were associated with the company from its very earliest days. They took a considerable part in the great struggle which the company had for its existence. It was hard to appreciate to-day that an invention of this great value and an organisation of such immense utility should have required many years of very hard work and persistent canvassing before justifying its existence. They were glad that their late colleagues lived to see the great life-saving work of the company so amply demonstrated under successful commercial conditions. At no time before, perhaps, had the value of Mr. Marconi's invention and the utility of this company's organisation been more prominently emphasised than since the outbreak of war, and when peace once more obtained, an interesting chapter might be written of the part played by the 2,000 Marconi stations fitted upon the vessels of the mercantile marine under the control and management of the Marconi companies. Their thanks were due to their manager, Mr. Bradfield, and the other members of the staff, who had so ably handled their business during very difficult times; and the greatest appreciation was due to their magnificent army of telegraph operators, who had unflinchingly carried out their duties upon board ship. As an instance, he would mention the operator of the *Armenian*, whose cabin was blown to pieces by shell fire, but who stood to his duty to the end, and, he was glad to say, was saved unhurt. Again, all would probably have read of the admirable conduct of the operators on the *Lusitania*, who never left their wireless cabin until the hurricane deck alone remained above water. These incidents were merely typical of many which had occurred in the mercantile marine. Upon the outbreak of war they called upon their operators for volunteers to serve as operators both in the Navy and the Army, and there were some 400 of their men now in those services. They regretted to have to record the death of five of them who went down with their ships or were killed in action. On more than one occasion the Admiralty had expressed their satisfaction and their appreciation of the resource and courage displayed by their men.

Capt. H. R. SANKEY seconded the motion, and it was carried without discussion.

It was agreed, on the motion of Capt. SANKEY, seconded by Mr. H. S. SAUNDERS, that the remuneration of the directors should be £2,000, subject to such further sum, if any, as might be determined at the next annual meeting of the company, and that in respect of the year 1914 an additional £1,000 be paid to the directors.

Singapore Electric Tramways, Ltd.

FOR the year ended December 31st the directors report that after charging debenture interest, depreciation, and royalty paid to the municipality of Singapore, the accounts show a loss of £236, which, deducted from the balance to the credit of the profit and loss account at December, 1913, leaves £9,149 to credit of that account. The directors consider that £7,000 of this sum should be placed to a depreciation reserve account in view of the expenditure on track maintenance which they are advised will be necessary in the next few years.

In comparison with 1913, traffic receipts show a decrease of £5,529, 1,152,590 fewer passengers being carried. Car mileage shows a reduction of 26,892. The passengers carried per car mile were 7.43, as compared with 7.90, a decrease of .47 per car mile.

The traffic receipts for 1914, down to the outbreak of war, compared favourably with the previous year. For the five months ended December, 1914, they were considerably lower. The weekly receipts are still below the corresponding period of 1914, but lately the decrease has been less marked. The sales of energy for lighting and power purposes show an increase of 7 per cent. compared with 1913. The supply of current to the Tanglin district has not yet been commenced.

Of the additional plant referred to last year, the 350-KW. Diesel engine and generator, the 125-K.V.A. motor generator, and the A.C. switchboard have been erected. The two 187-K.V.A. Diesel engines and generators are in course of erection.

The directors again wish to place on record their appreciation of the services rendered to the company by the general manager and his staff of engineers and assistants.

Sir FRANK A. SWETTENHAM, G.C.M.G., presided, on July 6th, at the annual meeting, held at 19, St. Swithin's Lane, E.C. He said that on the credit side of the balance sheet additional expenditure of £14,863 was shown, which represented about two-thirds of the cost and re-erection of additional plant. The traffic receipts from the tramways were £66,958, a decrease of £5,529. They carried 14,921,000 passengers, as against 16,074,000. The expenses of the tramway undertaking represented 56 per cent. of the receipts, while the total Singapore expenses were 54.3 per cent. of the total Singapore revenue. Those figures compared with 50.9 per cent. and 49.5 per cent. in 1913. Until the outbreak of war the traffic receipts compared favourably with the corresponding period for 1913, but the last five months showed a decrease of 19 per cent., as compared with the same period in the previous year. For the three months ended March of the present year the falling off was only 13 per cent., and the traffics for April and May had recovered considerably, the decrease being only 5 per cent. He thought, therefore, they might regard it as fortunate that the undertaking was being affected only to the extent he had mentioned. The sale of electric current, notwithstanding the war, had continued to increase, the receipts from that source being £800 more than in 1913. On the matter of depreciation and provision for track renewals, a situation had developed about which it was necessary the shareholders should be informed. They had been advised by the manager that the system of their tramway track as originally laid had proved inadequate, and

that there were defects which called for renewal, and for placing the track on a new foundation. The rails also had worn to such an extent that it would be necessary to replace them in a far shorter time than might reasonably have been anticipated. The general manager had made a careful examination of the system, and had come to the conclusion that the relaying of the track and the replacement of the rails must be carried out, if possible, within the next five years. The necessary work must be paid for out of revenue, but when it was completed they were advised that the life of the track and of the rails might be estimated at about 40 and 16½ years respectively. An annually increasing sum had been placed to depreciation, but, as the renewals of the whole track and rails must be made in a far shorter time than was originally expected, the sums hitherto allotted would not bear the cost of the new work. It was, therefore, necessary not only to place to depreciation a larger sum annually, but the board had decided to create a special reserve to meet these charges, and to take £7,000 from the available balance brought forward from 1913 and place it under the heading of depreciation reserve. When they last met no one in this country had any idea that within a few months we should be engaged in the most terrible war of all times. When the war broke out the undertaking was doing so well that they confidently expected to be able to pay a dividend for the year 1914. However, the war had changed all that, and from August last the receipts had fallen off considerably and the prices of supplies had increased, so that the result of the year's working showed a loss, instead of the considerable profit they had anticipated. The question of dividend, therefore, could not be considered at the present time. Under the circumstances, he trusted the shareholders would reconcile themselves to devoting to depreciation larger sums than were felt necessary in the past. When the work of renewals had been completed they would have a line constructed on a far sounder basis than the one they now had, and the directors suggested that the cost of the work should be spread over a number of years. One result they could confidently look for from a renewal of the track and the rails was a reduction in the power and maintenance expenses.

Sir CHARLES PETRIE, J.P., seconded the motion.

Dr. MOODY said he thought the feeling of the shareholders was one of profound disappointment with the report. There was room for a very considerable reduction in expenditure. £8,286 was expended last year on maintenance of the permanent way, which was at the rate of something like £500 a mile. He was aware that some parts of Singapore were built on the mud, but he was interested in a large number of tramway concerns in many parts of the world, and he knew of no other company where the expenditure on maintenance was on such a scale. In his opinion, the board ought to have given them a dividend on the ordinary shares, even if it was only 4 or 5 per cent. He also thought that the expenses in London, which amounted to £2,000, or over 1 per cent. on the capital, could easily be reduced by half.

The CHAIRMAN, replying to Dr. Moody and other shareholders, said it was not the existing company that laid the track, and, therefore, they could not be held responsible in any way. He presumed it was laid on the advice of responsible engineers, but in practice it had not turned out to be successful, and it had not the sort of life they had a right to expect. The consequence was that it had been necessary to expend large sums of money relaying the track, and a great proportion of the money spent last year on maintenance had been expended on relaying the track on a continuous bed of concrete. In his opinion, it would not be right to replace the track and charge the cost to capital, even if there was the capital to meet the cost. In the end, if it was paid for out of revenue the shareholders would benefit. With regard to decreasing the London expenses by reducing the number of the board, the shareholders had that matter in their own hands—they could always refuse to re-elect the retiring directors if they thought it in the interests of the company to do so.

The report was then adopted.

Edmundson's Electricity Corporation, Ltd.

THE annual meeting was held on July 8th at Salisbury House, E.C. Mr. P. D. TUCKETT, who presided, said that the gross trading profit stood at £9,768, which was approximately the same as a year ago. The final result of the year's working was a net profit balance of £23,240, as compared with £23,125 last year. Under the circumstances, he thought they might well feel satisfied with the result realised, for during the last five months of the year, instead of doubling the substantial increases of profit earned during the first half, as under normal conditions might have been expected, a large number of the subsidiary companies actually lost more than the whole of such increases. The war effectually deprived them of what he believed would otherwise have proved to be an exceptionally prosperous year. There could be no question of any increased distribution in times like these. He had intimated how seriously the business had been affected by the war, and he very much feared that some of the adverse influences from which they were now suffering might be accentuated as the war proceeded, and even more markedly, perhaps, after the war, if it was unduly protracted. In any case, for some time to come they were unlikely to be able to raise fresh capital, and it was, therefore, incumbent on them to husband their own internal resources to the fullest extent. Having regard to the financial conditions which were likely to prevail for some time, as well as to the general uncertainties of the future, it should be a source of considerable satisfaction that they had been able so substantially to strengthen during the past seven years both their own position and that of the subsidiary companies. In addition to their own reserve, the subsidiary companies appropriated to reserve for the past year over £30,000 in excess of the provision made by them in 1908, besides showing an aggregate increase of over £13,000 in the amounts carried forward. This very marked improvement in the financial position, compared with what it was a few years ago, would, he hoped, enable them to meet successfully any strain to which the war might subject them, but these were necessarily most anxious times, and not times in which they could afford to take any chances. The balance sheet disclosed a stronger financial position than was shown a year ago; their cash resources having increased by some £20,000 and their reserve by some £16,000. Proceeding to deal with the results of the subsidiary companies, he said that the total connections during the year amounted to the equivalent of 155,285 33-watt lamps, an increase of 8 per cent., of which 32 per cent. were lighting and 68 per cent. power. The connections for the previous year, which were the largest they had ever had, represented the equivalent of 169,699 lamps, and it was probably owing only to the war that last year's connections were not still larger, for down to the time of its outbreak they considerably exceeded those for the corresponding period of the previous year. As it was, the connection was a very large one, and should go some way to counter-balance the loss of revenue which, he was afraid, they must expect from a good many of their old consumers. To enable them to supply this additional load, the subsidiary companies incurred a capital expenditure of £84,824, as compared with £96,384 in the previous year; whilst for the current year their capital expenditure would almost certainly show a considerable further reduction. The increase in the gross profits of the various undertakings was £8,377, as compared with increases of over £11,000 and £12,000 for the two previous years, but there, again, the poorer comparison was entirely due to the war, the returns to the end of July showing a steady improvement which promised to yield comparative results even better than those for the two previous years. Having referred in detail to the difficulties which the various subsidiary companies had encountered owing to the war, the CHAIRMAN said that to meet the increased costs of supply, and particularly the increased cost of coal, they had in most cases, in common with a great many other electric supply and gas undertakings, been obliged to raise their rates of charge, and they must hope that that would to a large extent compensate them for the increased costs to which they were now being put. Not the least serious loss they had sustained had been in the inevitable disorganisation of the staff consequent upon a number of their men joining the Colours. Altogether they had lost over 270 men, a number they could ill-afford to spare from their by no means over adequately staffed stations, for this was no easy time to replace skilled men trained in their service. Allowances to their dependents would involve a sum of something like £3,000 for the current year. They must not overlook the fact that an extra burden rested on those who remained and who were loyally and willingly striving by their extra efforts to minimise the loss they had sustained. They were no less discharging their duty, nor were they less entitled to receive their grateful recognition and thanks. In this connection, he desired to emphasise a feature of the situation which was not sufficiently recognised, and that was that the continued efficient running of public service undertakings such as theirs was just as essential to the successful conduct of the war as many of the activities more conspicuously connected with it, for, apart from the very real economy which they were effecting in the use of the country's coal by meeting the needs of the manifold industries of their various towns from a central station, instead of obliging each manufacturer to supply his individual needs, there were very few, if any, of their towns in which they were not supplying power for every variety of war service, including shell-making. It was most unfair to those of their men who were quite as anxious as their fellows to serve their country at this crisis, but whose clear duty required them to remain at their posts, to suggest that they were not doing their duty and serving their country in the best possible way; and yet, through failure to appreciate the nature of the work they were doing, he feared there was some tendency to throw some such reproach in their teeth. The Lancashire Power Co.'s profits increased from £23,000 to £30,000, and but for the war they would have been still better. He usually concluded his remarks by endeavouring to give them some indication of the prospects of the business for the current year. On this occasion the conditions were so altogether abnormal and uncertain that he felt it would be useless to attempt to make any forecast. At the same time, he did not want them to allow themselves to be unduly depressed by the somewhat gloomy features of the situation to which he had had to call attention. Those features existed, and were bound to affect them adversely, but how far they were likely to suffer it was impossible to foresee, for they could not yet tell how the last five months of the current year would compare with the corresponding war period of last year, nor how far their increased rates of charge might compensate them for the increased cost of supply. It largely depended on the

extent to which their consumers were going to economise in the use of current, and he was inclined to think that the tendency of their part to do so was likely to be more pronounced next year than this. Be that as it might, they were doing all in their power to counteract any losses they might sustain; and, after all, there was a very considerable margin of profit both in their own accounts and in those of the subsidiary companies to meet any ordinary contingency that might arise. Moreover, he would recommend them never to lose sight of the fact that, whatever might be the vicissitudes of the immediate future, they had a thoroughly sound and stable business which had shown wonderfully steady and satisfactory progress hitherto, and would, he did not doubt, do so again, even if some temporary setback should result from the altogether abnormal times through which they were now passing.

Mr. A. A. Campbell Swinton seconded the motion.

Replying to Sir Charles Cuff, the Chairman said they exercised the strongest pressure they possibly could on the subsidiary companies in regard to economy. The trouble with Edmundson's stations, speaking generally, had not been that they were running extravagantly, but that they had been running too cheaply. Until their very large investments in ordinary shares in the Urban Electric Supply Co. and the Lancashire Power Co. became productive—which he was afraid would not be the case for several years—they had no expectation of showing any large increase in the item of dividends and interest received and accrued.

The report was then adopted.

J. Stone & Co., Ltd.—The report for 1914 states that the satisfactory condition of the company's trade which prevailed throughout 1913 continued, and showed remarkable improvement, until the outbreak of war in 1914. There is a balance to credit of profit and loss account for the year's working, after full allowance for depreciation, &c., of £198,926, to which is to be added the surplus brought forward from 1913 of £125,162, making a total of £324,089. After paying the preference dividend the directors recommend that £20,000 be placed to the reserve fund (making it £165,000), a dividend of 10 per cent. per annum, and a bonus of 3s. per share being paid on the ordinary shares, leaving £189,039 to be carried forward.

Standard Waygood Hercules, Ltd. (Australia).—At the annual meeting held in Sydney recently, Mr. J. B. Nicholson, the chairman, stated that the figures in the balance-sheet showed little difference as compared with those of the corresponding period last year. The orders in hand at that time represented £130,000; now they stood at £105,000. When the war broke out last August their business suffered for a month or two, but during the past five months the company's operations had not proved nearly as disappointing as anticipated.

Cape Town Consolidated Tramways and Land Co., Ltd.—The report for 1914 shows a debit balance for the year of £1,894, carried to the balance-sheet, making the total to debit £9,997 carried to next year. No dividends have been declared by any of the subsidiary companies during the past year.

Anglo-American Telegraph Co., Ltd.—The directors have declared an interim dividend for the quarter ended June 30th, 1915, of 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock, less income-tax, payable on July 31st.

Dublin United Tramways Co., Ltd.—Interim dividends for the half-year ended June 30th, 1915, at the rate of 6 per cent. per annum on the preference shares, and 5 per cent. on the ordinary shares, both less income-tax.

Direct United States Cable Co., Ltd.—Interim dividend 2s. per share, less income-tax at 2s. 6d. in the £, being at the rate of 4 per cent. per annum, for the quarter ended June 30th.

Fraser & Chalmers, Ltd.—Interim dividend of 7½ per cent. on the preference shares, less income-tax.

Advertising Stamps.—The Benjamin Electric, Ltd., of Rosebery Avenue, E.C., have issued a series of three coloured poster stamps respecting their specialities.

Prices Advance.—The Sterling Telephone and Electric Co., Ltd., announce that owing to the further increase in the cost of raw material, and general expenses of production, the list prices in their ninth edition catalogue, and all current publications, are increased as from July 14th by a further 15 per cent., making an advance of 25 per cent. in all.

For Sale.—Bradford Corporation has for disposal one Pollitt & Wigzell's horizontal tandem compound condensing steam engine, one Holdsworth & Sons' steel boiler with Proctor's mechanical stoker, and a Green's fuel economiser. Particulars are given in our advertisement pages.

STOCKS AND SHARES.

Tuesday Evening.

There was a general expectation in the Stock Exchange that, after the War Loan subscription lists had closed, business would revive in all the markets. Up to the present, however, this has not come about. The public are waiting with the keenest interest to see at what price the new security will be started in the market. Until this takes place, activity in stocks and shares is not to be looked for; and, anyway, the absorption of so much capital from the investing classes is bound to make itself felt as a decided factor for some time to come. The British public have applied for the War Loan by way of permanent investment. Stagging there may have been, but, if so, it was on the smallest of scales, since everyone knew that allotments would be made in full, and that the possibility of an immediate premium on the stock was not sufficient to make application worth while from the speculative point of view.

It may now be assumed that the Treasury will consent to companies making new issues of stock, where the money is required, without insisting upon the strict conditions imposed for a month or two prior to the appearance of the War Loan. That every step should have been taken to ensure the successful launching of this colossal issue was meet and proper, so that individual hardships entailed thereby were cheerfully accepted, and nobody grumbled. The embargo, it would seem, may now be removed in so far as it relates to domestic concerns, more particularly those of the industrial world which require further capital for their business. Incidentally, it is obvious that such companies will have to offer very tempting terms in order to obtain their money; and the opportunity for investors to secure good stock at cheap prices is one that is likely to be with us for some time to come.

The influence of the War Loan will be felt in many ways, direct and indirect. We have already shown how 4 per cent. debenture stocks standing at 90 have been lowered to the neighbourhood of 80 as one first result of the issue. Should the price of the War Loan decline to a discount, other securities—more particularly those of the gilt-edged variety—will have to give way in proportion. It were well, therefore, to reiterate that security of interest payment is one of the principal things upon which stockholders should concentrate their attention. They will have to put up with depreciation of their investments. They must be prepared to hear that such-and-such a stock, though it be of the finest class, is not saleable. These things need trouble comparatively little, so long as dividends are secure. To the proprietors of debenture stocks and preference shares in first-class companies, the financial consoler may reasonably offer such points as these by way of comfort. The stock may be unsaleable, but not a whit the worse for that.

Somerset House, with the remarkable unfairness common to both the departments charged with the collection of death duties and of income tax, insists that the former shall be paid upon the nominal prices of stock officially quoted at purely artificial levels; so that it behoves everyone to live as long, and as well, as he and she can at present, from the point of view of subsequent beneficiaries, if not that of advantage to the payment of death duties to the State.

The war is costing £2,000 a minute, according to the Government calculations, so every £100 lent to the nation just now lasts for about three seconds. In that short sentence resides the kernel of the reasons why most securities are severely depreciated.

Home Railway stocks have in many cases made further progress towards recovery, and the chief one amongst electrical issues is a rise of 3 in Underground Electric income bonds. The coal controversy is again becoming acute, but the Home Railway market as a whole is enjoying subdued strength. When it is noticed that, in France, ordinary coal for furnace purposes costs something like three guineas per ton, there is a certain negative satisfaction to be drawn from the price at which coal can be bought wholesale to-day in this country.

The St. James' & Pall Mall Electric Light Co. has declared an interim dividend of 7 per cent. on its ordinary and preference shares, this comparing with 10 per cent. in the corresponding period last year. The reduction caused little or no surprise in the market, because it had been generally supposed that all the illumination companies would have to cut their distribution, in consequence of the war conditions prevailing in the streets and in the coal bills.

The list of prices shown overleaf is unaltered. South Metropolitan ordinary, after changing hands in the neighbourhood of 16s., reacted to 14s. 9d., so that apparently the people who paid 18s. 6d. for the shares a fortnight or so ago have now secured all that they wanted; in the absence of their support, the order to sell a hundred or two caused the quotation to recede. Business in the London shares is very quiet. County of London ordinary and preference are both offered at 11. The Newcastle-upon-Tyne Electric Supply Co. has postponed the question of an interim dividend on the ordinary shares, owing to the uncertainty of the situation. The preference are to receive an interim dividend of 2½ per cent.

The Marconi International Marine meeting produced an

interesting speech from Mr. Godfrey Isaacs in his review of the year. He paid tribute to the magnificent army of telegraph operators who unflinchingly carried out their duties on board ship, instancing, for one, the operator on the *Armenian*, Mr. Swift, whose cabin was blown to pieces by shell fire, but who stood to his duty to the end, and who was miraculously saved unhurt. He recalled the admirable conduct of the operators on the *Lusitania*, who never left their wireless cabin until the hurricane deck alone remained above water. These instances he declared to be merely typical of many which have occurred in the mercantile marine. The Marconi group of shares has been strong, and the loss of ¼ in the parent company's issues was more than recovered, the price at 1⅞ showing a rise of 3/16 on the week.

Telegraph issues on the whole are still depressed. Globe ordinary have reacted to their par price of 10, Eastern ordinary fell 2 to 125, and Anglo-American Telegraph preferred is now but a point above par. The relations between the United States and Germany, according to the newspapers, are once more becoming strained, though in the Stock Exchange the idea of America falling foul of Germany, so far as a rupture of diplomatic relations is concerned, continues to be scouted. The reply of the German Government to the American Note, however, has had a weakening effect upon most securities connected with the United States. British holders of Anglo-American securities sold largely during the last fortnight, in order to apply for the new War Loan, and probably the dullness noticeable in this class of stock is merely the result of a slight fit of indigestion on the part of the Wall Street Stock Exchange. The stock market in London is far more interested in the magnificent achievement of General Botha, whose triumph has done more than anything else to correct the somewhat depressing tone which certain of our newspapers have patriotically seen fit to adopt of late.

Chili Telephones remain at 6¾, undergoing no change on the issue of the report, which showed that the company lost about 900 subscribers, while it managed to maintain its gross receipts decidedly well, the net income being no more than $20,000 down on the year. The rate of exchange, however, militated against the net profit, reducing it to £48,000, which is about £9,000 less than that in the previous period. The directors decided to leave the dividend unchanged at 8 per cent.

Quite a feature of the markets within the past few days has been the swift rise in the Rio de Janeiro exchange, which caused a corresponding recovery in various issues connected with Brazil. A rise of 1½ has taken Brazil Tractions to 52. Anglo-Argentine Trams, on the other hand, are still drooping, the debenture stocks being principally affected. Mexicans exhibit no quotable change, but in view of the trouble which has broken out in Haiti, it is feared that President Wilson will feel more disinclined than ever to take any strong line in Mexico.

The Shawinigan Water & Power Co. is about to issue $1,237,500 new common stock at par; and as the current price of the shares is about 116, this will represent a substantial bonus to proprietors. Under present Treasury regulations, these proprietors will probably not be allowed to subscribe for the new issue, but they will no doubt have the opportunity for realising their rights; and application for permission to deal in these rights will be made to the Stock Exchange in due course.

The industrial group shows a good deal of steadiness, and Henleys have risen ¼ to 14¼. Telegraph Constructions, however, failed to pick up any of their sharp loss of last week. There is rather more doing in this market as a whole. Rubber shares are good, the improvement in the price of the raw material to 2s. 7½d. per lb. sufficing to sustain interest and to bring in fresh buyers. The armament group, too, is better, support for Vickers coming from Sheffield.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Blackpool-Fleetw'd	June 25	2,880	−2,007	25	11,605	− 2,218	8	..
Bristol	„ 25	39,629	− 775	25	230,081	+20,601	30·5	..
Chatham and Dist.	„ 17	5,214	+1,312	24	25,854	+ 443	..	..
Cork	July 1	9,241	− 10	24	12,638	− 209	54·25	..
Dublin	June25	26,021	− 471	25	149,892	+ 6,983	9·89	..
Hastings	„ 21	3,914	− 6·8	..	..	− 1,025	19·3	..
Lancashire United	„ 30	7,540	+ 467	26	43,375	+ 675	42	..
Llandudno-Col. Bay	July 2	1,549	− 168	30	8,065	+ 736	6·5	..
Tyneside	June 23	2,904	− 751	25	14,342	− 295	11	..
Anglo-Argentine ..	July 1	198,210	−21,936	26	1,332,691	−125,048	..	..
Auckland	June 4	20,511	− 408	48	248,109	+ 798	25·42	1·06
Calcutta	„ 26	17,358	− 487	..	..	− 5,666	..	..
Kalgoorlie, W.A. ..	April	2,841	..	17	10,203	..	..	..
Madras	June 30	3,767	+ 55	26	24,855	− 187	..	..
Montevideo ..	June	24,266	−3,783	34	226,694	−30,554	..	..
Dublin-Lucan Rly.	June 30	854	− 10	26	3,718	+ 135	7	..

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	Price July 13, 1915.	Rise or fall this week.	Yield p.c.
HOME ELECTRICITY COMPANIES.				
Brompton Ordinary	10	8½	—	£6 1 8
do. 7 per cent. Pref.	7	7¼	—	4 10 4
Charing Cross Ordinary	5	4	—	6 5 0
do. do. 4½ Pref.	4½	4	—	5 12 6
do. do. City Pref.	4½	3⅞ xd	—	5 16 2
do. 4 Deb.	4	82	—	4 17 7
Chelsea	5	4½	—	5 11 1
do. 4½ Deb.	4½	88 xd	—	4 17 10
City of London	9	13½	—	6 16 10
do. do. 6 per cent. Pref.	6	12	—	5 0 0
do. do. 5 Deb.	5	105 xd	—	4 15 8
do. do. 4½ Deb.	4½	90 xd	—	5 0 0
County of London	7	11	—	6 7 3
do. do. 6 per cent. Pref.	6	11	—	5 9 1
do. do. 1st Deb.	4½	96 xd	—	4 13 6
do. do. 2nd Deb.	4½	90	—	5 0 0
Kensington Ordinary	9	7	—	6 8 7
London Electric	4	1⅜	—	8 8 4
do. do. 6 per cent. Pref.	6	4⅝	—	6 3 1
do. do. 4 Deb.	4	82	—	4 16 5
Metropolitan	8½	8	—	5 16 8
do. 4½ per cent. Pref.	4½	3⅞ xd	—	6 0 0
do. 4½ Deb.	4½	90 xd	—	5 0 0
do. 3½ Deb.	3½	70 xd	—	5 0 0
St. James' and Pall Mall	10	7½	—	6 18 0
do. do. do. 7 per cent. Pref.	7	6¼	—	5 12 0
do. do. do. 3½ Deb.	3½	70 xd	—	5 0 0
South London	5	3	—	6 13 4
South Metropolitan Pref.	7	1⅛	—	6 4 5
Westminster Ordinary	9	7	—	6 8 7
do. 4½ Pref.	4½	4⅛	—	4 17 4
TELEGRAPHS AND TELEPHONES.				
Anglo-Am. Tel. Pref.	6	101	−1	5 18 10
do. Def.	1½	21⅜	—	6 18 0
Chile Telephone	8	6¾	—	5 18 5
Cuba Sub. Ord.	5	8¼	—	6 1 3
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	11⅜	—	*6 16 2
do. 4 Deb.	4	82½	—	4 17 0
Eastern Tel. Ord.	7	125	−2	*6 8 0
do. 3½ Pref.	3½	72	—	4 17 3
do. 4 Deb.	4	81	—	4 18 9
Globe Tel. and T. Ord.	6	10	— ½	*6 17 0
do. Pref.	6	11½ xd	—	5 6 8
Gt. Northern Tel.	22	34	—	6 9 5
Indo-European	65/-	52	—	6 5 0
Marconi	20	1⅝	+ 3/16	10 13 4
New York Tel. 4½	4½	95	—	4 18 0
Oriental Telephone Ord.	10	1⅞	—	5 6 8
do. Pref.	6	1 3/16	—	5 1 1
Tel. Egypt Deb.	4½	88	—	5 2 8
United R. Plate Tel.	8	5⅝	—	*7 19 10
do. Pref.	5	4⅜	—	5 2 7
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	12½	—	*6 10 6
do. 4 Deb.	4	88	—	4 16 5
HOME RAILS.				
Central London, Ord. Assented	4	78	—	5 9 7
Metropolitan	1½	25½	—	4 18 0
do. District	Nil	13½	+ ½	Nil
Underground Electric Ordinary	Nil	1⅜	+ ⅛	Nil
do. do. "A"	Nil	4/6	—	Nil
do. do. Income	6	75	+2	*9 8 0
FOREIGN TRAMS, &c.				
Anglo-Arg. Trams, First Pref.	5½	4½ xd	—	6 13 4
do. 2nd Pref.	5½	8⅝ xd	—	7 11 9
do. 4 Deb.	4	78 xd	−1	5 2 7
do. 4½ Deb.	4½	80 xd	—	5 12 6
do. 5 Deb.	5	78	−1	6 8 2
Brazil Tractions	6	52	+1½	11 10 10
Bombay Electric Pref.	6	10½	—	5 16 10
do. 4½ Deb.	4½	90	—	5 0 0
Mexico Trams	Nil	33	—	Nil
do. 5 per cent. Bonds	—	60	—	Nil
do. 6 per cent. Bonds	—	80	—	Nil
Mexican Light Common	Nil	20	—	Nil
do. Pref.	Nil	30	—	Nil
do. 1st Bonds	—	45	—	—
Adelaide Sup. 6 per cent. Pref.	6	5	—	6 0 0
do. 5 Deb.	5	98	—	5 2 0
MANUFACTURING COMPANIES.				
Babcock & Wilcox	14	2⅛	—	6 4 5
British Aluminium Ord.	5	1 3/16	—	4 14 1
do. Pref.	6	18/8	—	6 9 9
British Insulated Ord.	15	11	—	6 13 4
do. Pref.	6	6	—	5 0 0
British Westinghouse Pref.	7½	36/-	—	8 2 2
do. 4 Deb.	4	70 xd	—	6 11 4
do. 6 p. lien	6	100	—	6 0 0
Callenders	15	11½	—	6 13 4
do. 5 Pref.	5	4⅝	—	5 2 7
do. 4½ Deb.	4½	95	—	4 14 9
Castner-Kellner	15	8½	—	4 12 6
Edison & Swan, £3 pd.	Nil	11/6	—	Nil
do. do. fully paid	Nil	1⅞	—	Nil
do. do. 4 Deb.	4	60 xd	—	6 13 4
do. do. 5% Deb.	5	60	—	8 6 8
Electric Construction	15	13/6 xd	—	8 17 10
do. do. Pref.	7	1 xd	—	7 0 0
Gen. Elec. Pref.	6	9⅞ xd	—	6 3 1
Henley	20	14¼	+ ¼	*8 0 6
do. 4½ Pref.	4½	4⅝	—	4 14 9
do. 4½ Deb.	4½	95	—	4 14 9
India-Rubber	5	8¾	—	5 14 3
Telegraph Con.	20	33	—	7 5 6

* Allowance made for dividends being paid free of income-tax.

British Electric Traction Co., Ltd.—The scheme for the reduction and rearrangement of the capital of this company is now in the hands of the proprietors, and will be considered at an extraordinary general meeting to be held at the Holborn Restaurant, on Friday next, July 23rd.

NEW RUSSIAN CUSTOMS TARIFF.

(*Concluded from page* 39.)

Poud = 40 funts = 36 lb.

*Imported by sea. † Imported over European land frontier.

	Old rate. Roubles. Per poud.	New rate. Roubles. Per poud.
Machines and apparatus, complete or incomplete, fitted together or in parts :—		
1. Of cast-iron, wrought-iron or steel, with or without parts composed of other materials even in combination with copper to an extent not exceeding 25 per cent. of the total weight of the machine :—		
(*a*) All kinds not specially mentioned	2·10	2·80½* / 3·36⅔†
(*b*) Gas and petrol motors, steam engines, portable engines and electro-motor wagons ...	3·20	4·01½* / 4·81⅔†
(*c*) Machines for the working of metals	4·20	5·11½* / 6·13⅔†
2. All kinds of machines made of copper or its alloys, or in the composition of which copper or any alloy of copper is present in a proportion exceeding 25 per cent. of the total weight of the machine	8·00	9·90* / 11·88†
3. Dynamo-electrical machines and electro-motors of all kinds ; electrical transformers	8·50	9·35* / 11·22†
7. Parts of machines and apparatus imported separately from the machines or apparatus to which they pertain, not specially mentioned :—		
(*a*) Composed of copper or alloys of copper, or in the composition of which copper or any alloy of copper is present to an extent exceeding 25 per cent. of the total weight of each separate part	8·00	9·90* / 11·88†
(*b*) Composed of cast-iron, wrought-iron, or steel, even though with parts consisting of other materials, or in combination with copper, if the copper does not exceed 25 per cent. of the weight of each separate part	4·20	5·11½* / 6·13⅔†
8. Spare parts of machines or apparatus, not specially mentioned, imported with such machines, as par. 7 (*a*)	8·00	9·90* / 11·88†
9. Spare parts of machines or apparatus, imported together with such machines or apparatus, composed of cast-iron, wrought-iron, or steel, even though with a combination of copper not exceeding 25 per cent. of the weight of each separate part :—		
(*a*) Imported with any of the machines enumerated in subdivision (1) (*a*) above	2·10	2·80½* / 3·36⅔†
(*b*) Imported with any of the machines enumerated in subdivision (1) (*b*) above	3·20	4·01½* / 4·81⅔†
(*c*) Imported with any of the machines enumerated in subdivision (1) (*c*) above	4·20	5·11½* / 6·13⅔†
10. Parts of dynamo-electrical machines and transformers are admitted conformably to the respective letters under sub-division (7) above, except the parts enumerated below :—		
(*a*) Induction coils	17·70	19·47 * / 23·36⅔†
(*b*) Armatures and commutators ...	12·75	14·02½* / 16·83 †
(*c*) Frames with parts (other than brasses) of copper...	8·50	9·35 * / 11·22 †
Physical, astronomical, mathematical and similar instruments and apparatus, also electrotechnical accessories :—		
1. Electrical current interrupters, commutators, safety cut-outs ; holders for electrical incandescent lamps ; rheostats and commutators of all kinds, fitted together or in parts ; telegraphic and telephonic apparatus ; electric bells and accessories for electric signalling	9·00	13·20
2. Electrotechnical measuring appliances (ammeters, wattmeters, voltmeters and calculators) ...	12·00	16·50

NOTE.—The rates of duty specified in subdivisions (1) and (2) of the present No. are also applicable to separate parts of the apparatus mentioned in the said subdivisions.

3. Electrical incandescent lamps with filaments of carbon covered or not with metal :—		
(*a*) Mounted	30·00	33·00
(*b*) Without mounting	60·00	66·00
4. Electrical incandescent lamps, with metal filament :—		
(*a*) Mounted	65·00	71·50
(*b*) Without mounting	90·00	99·00

NOTE 1.—Vessels for medical or pharmaceutical use in laboratories, composed of clay, stoneware, glass, porcelain or the like, pay duty according to the sections of the Tariff applying to those materials respectively.

NOTE 2.—Similarly, spare parts of electrical cells, batteries and other appliances, which wear out by use and require to be replaced by new ones, such as zinc, copper and other plates for cells, carbons for the same and for lamps, lanterns, &c., pay duty according to the respective sections of the Tariff.

AN INVESTIGATION OF DIELECTRIC LOSSES WITH THE CATHODE-RAY TUBE.*

BY JOHN P. MINTON.

CAREFUL study of insulating materials is becoming more and more important, and it is certain to become much more noticeable in the near future.

Heretofore, the electrical tests made on insulation have largely been voltage, capacity and resistance measurements. These measurements do not tell us enough, and on account of their inadequacy the measurement of the dielectric losses and power factors of insulating materials becomes of much importance. By means of such measurements one is able to study a piece of insulation up to almost the breakdown point under a variety of conditions, and over and over again. Such measurements will reveal to us more about insulation than all the three tests referred to above.

The reason why such measurements have not been carried out on a large scale before is the difficulty of securing instruments which will measure small losses at very high voltages. Prof. Ryan first suggested the use of the cathode-ray tube for this purpose, and showed how it could be used. The development of the "cyclograph," which is the name given to the cathode-ray tube wattmeter, was begun in 1911 at the Pittsfield Laboratory, and has been accomplished, so that it is a satisfactory apparatus to measure dielectric losses up to almost any desired voltage, from very small to large losses, and from low to high frequencies, so long as a continuous alternating potential is available. The cyclograph has been in continuous use in this laboratory during the past two years, and a large amount of valuable information has been gained both on cathode-ray tubes and on insulation.

Since the method of determining the dielectric losses with the cyclograph is quite different from that described by Prof. Ryan, it will be necessary to show how the apparatus is used for this purpose. The cathode ray tube, M, is an evacuated glass tube of the dimensions and shape shown in fig. 1 (p. 92). Under the proper conditions, a direct potential of about 20,000 volts, applied between the cathode C and the grounded anode, a, will cause a stream of cathode rays to originate at the cathode and travel at a very high velocity towards the other end. It is necessary to have C the negative terminal because the cathode rays consist of electrons which possess negative charges. A grounded brass diaphragm, d, intercepts all these rays with the exception of those which pass through a round hole about $\frac{1}{32}$ in. in diameter in this diaphragm. This small pencil or bundle of rays travels to the lower end of the tube, where it strikes the fluorescent screen S. This screen is usually made of calcium tungstate ($CaWO_4$), or zinc sulphide (ZnS), or some other salt which is strongly fluorescent when subjected to the bombardment of cathode rays.

*Abstract of paper read before the AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, July 2nd, 1915.

In order that the fluorescent figure on the screen may be symmetrical with respect to the centre, it is necessary in this scheme to use two pieces of similar insulation. These two pieces are represented by A and B and are placed between the test terminals in the oil-box, O, as shown in fig. 1. Suppose now a high-potential sine wave is applied to these test pieces by means of the transformer T, and that it is desired to measure the dielectric loss in them. Fig. 1 shows the diagram of connections to be used. For this purpose, a sine-wave potential, proportional to the voltage across the test terminals in the oil-box, is applied to the potential

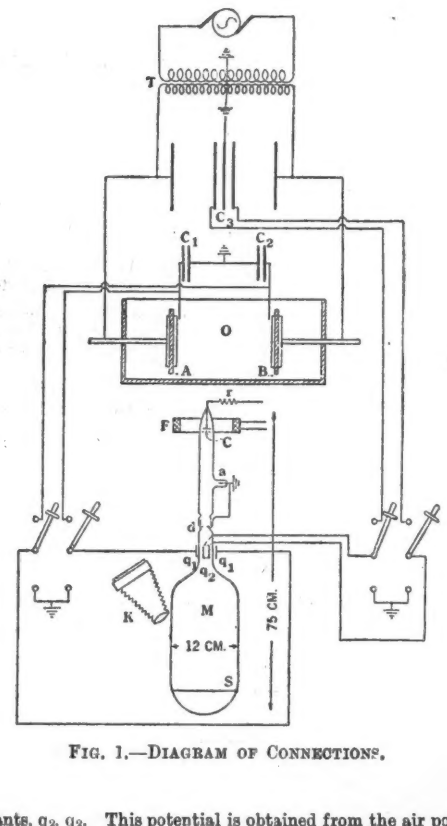


FIG. 1.—DIAGRAM OF CONNECTIONS.

quadrants, q_2, q_2. This potential is obtained from the air potential condenser C_3, as shown in the diagram. This potential produces the deflection of the cathode-ray spot on the fluorescent screen S, as shown by b b in fig. 2. Since the cathode rays possess no appreciable inertia, it follows that this deflection is directly proportional to E.

To the current quadrants, q_1, q_1, is applied a potential e_1, proportional to the current passing through the insulation under test in the oil-box. This potential is obtained from the air current condensers, C_1 and C_2, as shown in fig. 1. The voltage across an air condenser is directly proportional to the current passing through it. The current that passes through these condensers is that which passes through the insulation under test. This potential e_1 produces the deflection a a of the cathode-ray spot as shown in fig. 2, proportional to e_1.

When both of these potentials act on the cathode-ray stream simultaneously, an ellipse is formed on the screen, S, by the

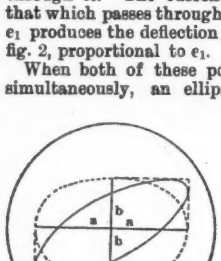


FIG. 2.

FIG. 3.

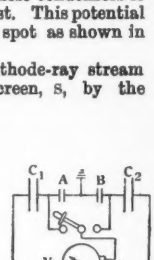


FIG. 4.

FIG. 2.—FIGURE PRODUCED ON THE SENSITIVE SCREEN S.
FIG. 3.—VECTOR DIAGRAM FOR TESTING CIRCUIT.
FIG. 4.—CONNECTIONS OF ELECTROSTATIC VOLTMETER.

fluorescent spot, as in fig. 2. The area A of this ellipse is proportional to the power lost in the insulation and air condensers, C_1 and C_2, and since the loss in the air condensers is negligible, we see that the area of the ellipse is proportional to the dielectric loss in the two pieces of insulation under test. Calibrations are avoided by the use of the cyclograph as a power factor meter and by measuring the currents and voltages independently. The latter quantities can be determined without trouble, and the power factors are easily obtained from photographs taken of the fluorescent figure.

If the power factor of the circuit were unity instead of $\cos\theta$, the area, A_0, of the ellipse would be represented by the dotted ellipse in fig. 2, and $A_1/A_0 = \cos\theta$. A_1 can be obtained by measuring the major and minor axes of the actual ellipse formed by the fluorescent spot on the screen; A_0 can be obtained by measuring a and b, fig. 2. Hence, $\cos\theta$ can be determined. This makes it evident that it is advisable to make three exposures for each photograph, one of the ellipse, one of the deflection a, and one of the deflection b. However, one exposure, that of the ellipse, would be sufficient to determine $\cos\theta$.

This is the value of the power factor of the circuit, but one desires the power factor of the insulation which is being tested. This is obtained from fig. 3, which is the vector diagram for the circuit consisting of the two test pieces and air condensers C_1 and C_2. The voltage across this circuit is represented by E, and the current passing through it is represented by I, leading E by an angle θ. e_1 is the potential drop across the air condenser, and it is at right angles to I. E′ is the voltage drop across the insulation, and θ' is the phase angle between I and E′. The power factor of the insulation, therefore, is $\cos\theta'$, which is the one sought.

Approximately,

$$\cos\theta' = \cos\theta + \sin 2\theta \cdot e_1/2\,E'.$$

The current that passes through the insulation also passes through the air condensers C_1 and C_2. Under normal conditions, the current passing through any air condenser is given by $I = 2\pi f C e_1 \times 10^{-6}$ amperes,

where e_1 = potential in volts across the condenser,
C = capacity in mfd. of the condenser,
f = frequency of the applied potential.

So that this equation can be used to obtain the current passing through the insulation.

The voltage, e_1, across the air condensers has been determined with a 120-volt Kelvin electrostatic voltmeter used with two auxiliary condensers, one connected on each side of the ground between C_1 and C_2 in fig. 1. One terminal and the metallic case of the electrostatic voltmeter can be grounded, and the auxiliary condensers are sufficiently large to permit the 120-volt Kelvin meter to be connected directly across them. In fig. 4 the average of the readings across A and B is taken to represent the value of e_1 to be used; e_1 varies from 600 to 3,000 volts, depending on the conditions of test. This method is quite satisfactory, and can always be relied upon to give accurate results. The loss in these condensers introduces no appreciable error in the results.

The air capacities, C_1 and C_2, or these in series with the two auxiliary condensers A and B, range from about 0·003 to 0·015 microfarads. This range has been found sufficient. The frequency

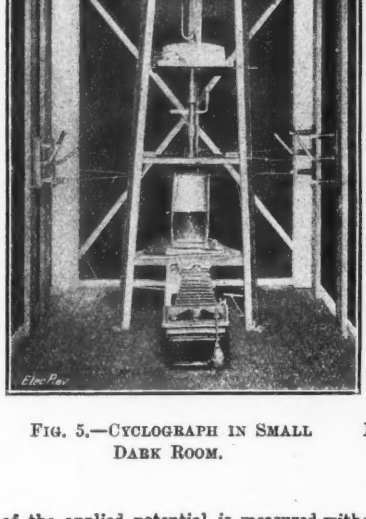


FIG. 5.—CYCLOGRAPH IN SMALL DARK ROOM.

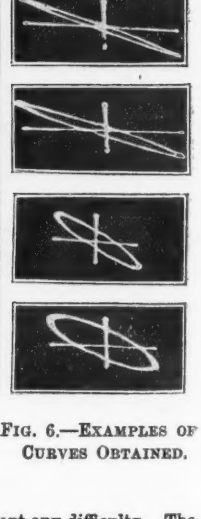


FIG. 6.—EXAMPLES OF CURVES OBTAINED.

of the applied potential is measured without any difficulty. The current per sq. cm. can be obtained by dividing the total current by the area of the testing terminals; all the current values given in this paper are in milliamperes per sq. cm. The test terminals used were either 20 or 25·4 cm. in diameter, and results obtained with 10-cm. terminals were the same as those obtained with the 25·4-cm. ones, so that the edge effect was negligible.

The voltage E applied to the test terminals was obtained by reading the voltage on the low side of the testing transformer, and calculating E by the ratio of transformation. The voltage E′ across the insulation can be calculated. The watts lost in the two pieces of insulation under test are given by the equation

$W = E' I \cos \theta'$, where the potential and current are in volts and amperes respectively. Watts per cu. cm. can be obtained by dividing the total watts by the actual volume of insulation under test.

About 30 seconds are required to make the three exposures for each photograph, and about a minute more is required to obtain all the other necessary readings. In about 10 minutes we can secure data to give curves showing watts vs. voltage, current vs. voltage, and power factor vs. voltage.

An illustration of the cyclograph, as it is set up in the small dark house, is shown in fig. 5.

In the literature on cathode-ray tubes, reference is made to trouble encountered with "hardening" and "softening" effects in these tubes. The "hardening" is an increase and "softening" a decrease of the vacua. Satisfactory tubes should maintain constant vacua of the desired magnitudes under all ordinary conditions of operation. The development of such tubes was undertaken. It was finally shown that the vacuum "softened" because too much gas was adsorbed on the surface of the electrodes and glass walls. It was found that if the tubes were exhausted three or four hours at perhaps 350° C., sufficient adsorbed gases were liberated from the glass walls and electrodes to maintain constant vacua over long periods of time. One tube has now maintained a constant vacuum for almost two years, and there is no indication that it will not maintain this vacuum for a number of years, although it is used almost daily. Not one exception to this rule has been found.

Another difficulty was due to electrostatic charges which accumulated on the glass surrounding the aluminium cathodes. These charges were of a positive sign, and since the cathodes were negative, discharges would occur between the cathodes and glass as soon as the potential differences reached a sufficient magnitude to cause the discharges. Such discharges always caused the cathode ray streams to be unsteady, and frequently resulted in flash-overs within the tubes between the cathodes and anodes. The flash-overs were prevented by the use of high resistances (perhaps 100,000 ohms each) such as high-resistance lightning arrester rods, in the cathode leads. These resistances should connect immediately to the cathode terminals, as shown by r in fig. 1. These resistances not only prevent flash-overs, but they also cause the tubes to operate much more steadily. They do not, however, prevent discharges from occurring between the cathodes and the glass surrounding them.

It was noticed that tubes whose vacua "softened" during operation never gave any trouble due to these electrostatic charges. Tubes which had been exhausted several hours at a high temperature in order to eliminate vacuum changes were always unsatisfactory, because of the difficulty with the charges. Since the adsorbed gases are liberated from the glass during exhaustion at about 350° C., it would seem that the reason the charges accumulate during operation of the tubes is on account of a film of gas on the glass being necessary for conducting away the charges to the cathodes. The following scheme of exhaustion was found to eliminate all trouble of this kind. The idea was to remove a sufficient amount of the film of gas by exhausting the tubes at a high temperature, in order to allow a constant vacuum to be maintained and still leave on enough of the film to conduct away the charges which collect on the glass surfaces. After some experimenting it was found that if the tubes were exhausted at about 350° C. for, perhaps, a half-hour, the vacua would remain constant during several hours of continuous heavy operation, and no trouble would be experienced on account of charges on the glass surrounding the cathodes. Exhaustion at a high temperature for this time was sufficient to avoid vacuum changes over long periods. This method of exhaustion has been tried on a number of experimental tubes and found to be satisfactory.

Soft sodium glass has given less trouble with these static discharges than any other glass tried. This glass is also easy to work.

The deflecting quadrants can be placed outside the tubes, which greatly simplifies their construction. It also permits easy adjustment of the magnitude of the deflections, a thing which is highly desirable in this work. The quadrants are made of pieces of brass about 0·5 in. × 1 in., and they must be supported by a material which has a very high insulation resistance and does not change due to surface leakage or otherwise. Hard rubber serves this purpose nicely, and accurate results can always be obtained with it. The switches connecting the leads to the potential quadrants should have hard rubber bases with considerable leakage surface. Since the current condensers are so much larger than the potential one, it is not necessary to have such highly insulated switches.

During damp weather moisture will deposit on the surface of glass. Formerly this always happened with the cathode-ray tubes, and sometimes it was impossible even to deflect the rays, because the deposited moisture acted like a metallic shield for the rays.

It was necessary to make the tubes completely non-hygroscopic in the neighbourhood of the quadrants in order to ensure satisfactory results. Cellulose nitrate has been used for this purpose, and it has been found quite satisfactory.

The kenotron has been tried as a means of exciting the tubes; it produces a steady cathode-ray stream, and there is no apparent reason why it could not be used to good advantage in this work. The mechanical rectifier has been largely used in connection with the cyclograph for producing the cathode rays.

The focusing coil, F (fig. 1), is used for concentrating and increasing the brightness of the fluorescent lines on the screen. The focusing coil is always placed so that its plane coincides with that of the cathode.

(To be continued.)

SOCIETIES AND INSTITUTIONS.

As we are frequently asked through the post for the addresses of electrical, engineering, and scientific institutions and associations, we give below a list of these. The addresses given are those of the secretaries. We propose to republish the list about four times a year.

Associated Municipal Electrical Engineers (Greater London), Electricity Works, Squires Lane, Finchley, N.
Association of Electrical Station Engineers, 41, Warren Road, Leyton, N.E.
Association of Engineers-in-Charge, St. Bride's Institute, Bride Lane, London, E.C.
Association of Consulting Engineers, Inc., 11, Victoria Street, London, S.W.
Association of Mining Electrical Engineers, Bank Chambers, London Road, Derby.
Association of Supervising Electricians, St. Bride's Institute, Bride's Lane, London, E.C.
Batti-Wallahs' Society, 25, Victoria Street, London, S.W.
British Electrical and Allied Manufacturers' Association, Inc., King's House, Kingsway, London, W.C.
British Engineers' Association, 32, Victoria Street, London, S.W.
British Association for the Advancement of Science, Burlington House, London, W.C.
Chemical Society, Burlington House, London, W.C.
Diesel Engine Users' Association. Chelsea Electricity Supply Co., 19, Cadogan Gardens, Chelsea, S.W.
Electrical Contractors' Association., Inc., 20, Bucklersbury, London, E.C.
Electrical Trades' Benevolent Institution, 18 & 21, Park Mansions, Vauxhall Park, S. Lambeth Road, London, S.W.
Electrical Trades' Union, 137, Great Clowes Street, Broughton, Manchester.
Electro-Harmonic Society, Finsbury Pavement House, London, E.C.
Faraday Society, 82, Victoria Street, London, S.W.
Illuminating Engineering Society, 32, Victoria Street, London, S.W.
Incorporated Association of Electrical Power Companies, Caxton House, Westminster. S.W.
Incorporated Municipal Electrical Association, 28, Bedford Square, London, W.C.
Institute of Metals, Caxton House, Westminster, London, S.W.
Institution of Civil Engineers, Great George Street, Westminster, London, S.W.
Institution of Electrical Engineers, Victoria Embankment, London, W.C.
Institution of Mechanical Engineers, Storey's Gate, St. James's Park, London, S.W.
Institution of Mining Engineers, 39, Victoria Street, London, S.W.
Institution of Post Office Electrical Engineers, G.P.O. West, London, E.C.
Iron and Steel Institute, 28, Victoria Street, London, S.W.
Junior Institution of Engineers, 39, Victoria Street, London, S.W.
London Electrical Engineers, Territorial Force, 46, Regency Street, London, S.W.
Metropolitan Association of Electric Tramway Managers, Corporation Tramways Department, Croydon.
Municipal Tramways Association, Inc., Tramway Offices, 7, Hall Ings, Bradford.
Physical Society of London, Imperial College of Science, South Kensington, London, S.W.
Post Office Telephone and Telegraph Society of London, G.P.O. (North), E.C.
Röntgen Society, 7, Harley Street, London, W.
Royal Institution of Great Britain, 21, Albemarle Street, London, W.
Royal Society, Burlington House, Piccadilly, London, W.
Royal Society of Arts, 18 and 19, John Street, Adelphi, London, W.C.
Society of Engineers, Inc., 17, Victoria Street, London, S.W.
Tramways & Light Railways Association, Caxton House, London, S.W.
Wireless Society of London, 107, Hatton Garden, London, E.C.

Standardising Electrical Motor-Car Fittings in the U.S.—Elaborate studies of electrical equipment for petrol motor-cars have been made by the Electrical Equipment Division of the Standards Committee of the American Society of Automobile Engineers. A number of recommendations on such points as interchangeable bulb bases and connector plugs, the use of conduit in installations, the methods of earthing circuits, connectors, fuses and their rating and installation, and methods of battery installation in connection with electric lighting and engine starting sets have lately been made. Among the more suggestive recommendations is one that before any electrical appliance is added to the equipment of a car after it is sent out from the manufacturer's works, a description of it be sent to the car maker in order to secure his recommendation as to its suitability, and the best method of applying it to the particular car. In place of the terms "single wire" and "two-wire" systems, now generally used, the Division prefers to call them "insulated return," in the case of the latter, and "grounded return" as regards the former. Metallic conduit is preferred for protecting conductors, and rules for its construction and use are specified in considerable detail. The adoption of fuses, rated respectively at 10, 20 and 30 amperes, is recommended, while fuse ratings must be in accord with the specifications of the American National Board of Fire Underwriters. Battery installations must be so carried out, that neither acid fumes nor overflow of water or electrolyte will cause serious leakage of current. Battery hold-down bolts, if connected to metal handles or other metal parts at the top of the jars, must be insulated at one end at least. Among other matters that are under consideration is that of perfecting the standards for lamp bulb bases, connecting plugs, and receptacles. Hitherto connectors have not universally interchanged with lamp sockets, but standard plugs have now been laid down, which will fulfil this requirement. Occasional difficulty in fitting bulbs into their sockets, owing to irregularities in the manufacture of the bulbs, will also be done away with when the new standard calling for a reduction in the length of the socket of $\frac{1}{32}$ in. comes into effect. A desire has also been expressed for the reduction to standard form of certain dimensions of electric engine starting units, with the hope that the interchange of different makes of starter might thereby be facilitated. The Division has, however, not proceeded beyond the preliminary stages of its investigation, and thus far has found little to indicate that practice has settled down sufficiently to warrant the attempt at standardisation at the present time.

UNITS FROM REFUSE.

By A. J. ABRAHAM, M.I.E.E.

My excuse for writing this short article is that I have served in combined electricity and destructor stations since 1901, and my humble object is to bring this experience before more able engineers who have hitherto treated lightly the immense possibilities of town refuse.

Everyone will admit that, from the health point of view, the only way to deal with refuse is to cremate it, and that the authority which still tips this around the neighbourhood for reasons of false economy should be open to criminal prosecution—unfortunately this is not the case! My chief complaint is that even the leading destructor makers have got into a groove or, perhaps, have been pushed into this groove, and the result is that while the average destructor is excellent for the purpose of destroying refuse, justice cannot be done to the refuse from a steam raising point of view. The consequence is that in various parts of the country to-day there are electricity works hampered with the inevitable drawbacks of a destructor which is absolutely useless for steaming boilers, and the electrical engineer rightly considers that he has a millstone tied round his neck. As stated above, destructors have in the past been designed solely with a view to burning refuse, and where these have been combined with an electricity works, either all the value of the radiant heat has been allowed to go to waste in the combusion chamber, *thereby in most cases reducing the steaming efficiency of the destructor by nearly 50 per cent.*, or else the space under the boilers has not been large enough to consume all the gases and otherwise act as a perfect combustion chamber. During ordinary quiet working in the Aberdare destructor we evaporate an average of 4 lb. of water per lb. of refuse "from and at." On our peak, however, for the purpose of saving refuse, we abandon the destructor and burn refuse directly under the boilers with specially constructed furnaces, and with the latter arrangement we can evaporate considerably over this amount of water per lb. of refuse "from and at." Neither arrangement is an ideal one for obvious reasons, and had there been no Local Government Board inquiry (where one set of experts proved that our proposed scheme would be a drastic failure, and the other set proved that it would be a success), and had we known what experience has since taught us about this wonderful refuse *before the works were planned*, a combination of the present arrangement would no doubt have been installed in the destructor, and in place of our present small non-condensing units, the Consulting Engineer would have had the wherewithal to install larger condensing units. The results of such a plant would have staggered both destructor makers and electrical engineers.

Last year Aberdare Electricity Works generated 1,110,229 units. Only nine tons of coal were burnt and produced 1,827 units, whereas 13,011 tons of refuse were destroyed and 1,108,402 units were generated by refuse, or an average of over 85 units per ton of refuse for the whole year, and this figure includes all refuse used for steam raising and banking, steam for forced draught, pumps, crusher engine and the large quantity of steam which was blown off to atmosphere. These figures become more interesting when it is repeated that our engines are small units, consisting of 100 KW. and 200 KW. sets which exhaust to atmosphere, and there are no economisers installed. For fear of being laughed to scorn, I hesitate to give the amount I consider we should easily be able to increase the figure of 85 units per ton of refuse to, if we were working a destructor of an absolutely novel and proved design in combination with one fairly large turbo-generator driving both lighting and traction, and running condensing on superheated steam in conjunction with economisers. In view of our present figures anybody will, however, surely agree that the average figure of 85 units could be increased to 160 units per ton, and given a load factor of 25 per cent. up to 250 units per ton of refuse destroyed.

Thanks to refuse and the enthusiasm of the Aberdare Council and the loyalty of the staff, our tramways (also run by refuse) made a surplus last year of some £3,600, and our electricity department about £1,200, and to show that the destructor shared in the general prosperity, it may be mentioned that the portion of the destructor revenue derived from the sale of steam nearly paid for the labour cost of destroying the refuse—and this in spite of the high price of labour in this district.

There is no doubt but that the three combined schemes, namely, destructor, electricity works, and tramways are, as a whole, the most successful combination in the Kingdom.

Our electricity working costs per unit sold on an output of just over one million units are 0.72 pence, and the Aberdare people enjoy the cheapest electricity in South Wales, the average price obtained being 1.57d. per unit.

In face of the above example there is a neighbouring Council nearly adjoining Aberdare who are tipping refuse nearly as valuable as coal and buying current in bulk from a power company. Moreover, they are at present extending this short-sighted policy, although in the future they propose to lay down electric tramways. I think such an authority would be in a better position to buy electricity in bulk *after* they had made full use of their splendid refuse and dealt with it in a sanitary manner, when they could say to some company: "Our present cost of generating electricity is 0.7d. per unit sold. What is your price if we improve your load factor by generating with refuse during your peak load?"

They would also have a better case for their proposed Tramway Bill. What is going to happen in such places when the tips fill up and there is no space for either refuse *or useless destructor residue?* Would it not be better to save tipping space for destructor residue rather than fill up this available space with refuse, especially as the bulk of refuse is 75 per cent. more than the destructor residue would be?

To take the case of a neighbouring town of 40,000 inhabitants and using the experience already gained, the following extraordinary result is not a fairy tale but can be guaranteed with perfect safety to any authority in this district, within a few years after the works started a supply:—

Refuse destroyed per annum	12,000 tons.	
Units sold—private supply per head of population = 20	=	800,000
Public lighting	=	100,000
Tramways	=	400,000
Total units sold		1,300,000
Total units generated ...		1,400,000
The *total* labour cost of dealing with 12,000 tons of refuse per annum		£1,400
Destructor revenue from Electricity Department—1,400,000 units at .25d.		£1,400

So that the authority, instead of either wasting the heat and paying, say, £1,000 per annum for labour in order to get rid of their refuse or sending out notices *re* killing flies, and at the same time polluting the neighbourhood and spreading disease, would be able to destroy all refuse for the maintenance and capital charges of their destructor.

The electricity department would also reap the benefit of a fuel cost of .25d. per unit generated on the low output of 1,400,000 units, and such a cost

with coal could otherwise only be obtained on an output of five or six times this amount. For future comparison it could reasonably be expected that 12,000 tons of this refuse will generate up to 2,000,000 units for the same labour cost, leaving the destructor with a sum of about £166 per annum in hand for maintenance of plant, *after* the charge of .25d. to the electricity department had been reduced to .2d.

Another authority I know of have recognised the tremendous value of the refuse, and have made a bargain with a power company to exchange current. I do not know the arrangement, but if a million units have to be pumped into the company's system before a revenue of £2,000 is obtained, the arrangement appears to me to be an excellent one (for the power company), when it is borne in mind that Aberdare selling the cheapest electricity in South Wales makes a revenue of about £7,000 per million units; in the earlier days of the undertaking we should have been glad to supply our surplus heat for ½d. per unit at our switchboard, and could do with a similar arrangement at the present time *provided* that we were not bound to supply a certain number or any units after we could get a better price for them directly from our own ratepayers.

Now, between the typical refuse of South Wales and the ordinary refuse which I have used in England and Scotland, there is not so much difference as one would imagine. Although by injudicious use and the slightest attempt at forcing we can soften the firebrick lining (3,074° F.) in the Aberdare destructor, yet we find it pays us to keep a combustion chamber temperature of not more than 2,300° F., or a heat hovering between orange and white. Our heat, however, is absolutely constant. With very poor refuse in 1901, nickel could often be melted in the furnaces. In 1903 the Manchester Steam Users' Association carried out tests at the Nelson destructor and obtained furnace temperatures from 2,300° F. to 3,100° F., and destroyed an electric platinum wire resistance pyrometer when trying to take the temperature of the combustion chamber. In Cambuslang Electricity Works ten years ago, with poor Scotch residential district refuse, we ran the combustion chamber at a temperature of nearly 3,000° F. for eight hours a day and seven days a week, and did not even stock coal. So that there is not the slightest doubt but that from *any* refuse ample heat can be obtained. The difference, of course, is that, all other things being equal, in South Wales on a grate area of 25 sq. ft. you will have a job to properly destroy, without injuring the destructor, 10 cwt. of refuse per hour; whereas in average districts nearly double this quantity could be cremated for the same useful heat. With the very poorest class of refuse there is no reason why 2½ lb. of water per lb. should not be evaporated.

In 1903 a Lancashire colliery town had undoubtedly a good destructor for destroying refuse, but as a steam raising plant during the years ended March, 1906, to 1912, it appeared to be a failure. The population was in 1912 45,000, so that about 14,000 tons of refuse should have been available, and there is no doubt but that with a properly designed steam raising destructor 840,000 units could easily have been generated at a fuel cost of .25d., and a destructor labour cost of nothing or next to nothing.

As, however, the unfortunate engineer had the aforementioned mill-stone hanging round his neck, this is what happened with good refuse at this town for the year ended March, 1912:

Net deficit on electricity undertaking	£311
Units sold	819,261
Fuel cost	.43d. per unit sold.

It would be instructive to know on top of this what was the labour cost of destroying the refuse per ton, and whether all the refuse (taken at 14,000 tons) was destroyed, and what income the destructor derived from steam. Now, had it been possible at this time to take advantage of the refuse, the fuel cost would have been reduced by .16d. per unit sold, the destructor would have obtained a revenue for steam of over £850, the electricity department's deficit of £311 would have been a surplus of £235, and the ratepayers would not have had to spend £1,000 or so for coal.

During the year ended March, 1906, the units sold were 799,297; the deficit, £332. The cost of coal and coke was £1,328, *and the amount paid to the destructor for steam £150.* To-day the above appears to be a very sad result, and it is similar results all over the country which make the unfortunate engineers in charge of such plants loathe the name of destructor.

From experiments which I have carried out, and from bitter experiences with front feed, back feed, top feed, and tub feed destructors, I have come to the conclusion, if you want steam and proper combustion without undue dust:—

1. That the ashpit pressure of any destructor should not exceed 1 in. of water.

2. That the cells should be front fed and below the combustion chamber, and the latter should have a false bottom for dust.

3. That large water tube marine-type boilers with superheaters should be placed directly on top of the combustion chamber.

4. That separate steel stacks complete with dust-catcher (which can be cleared while working), economiser and fan draught at the chimney base should be provided for each boiler.

5. That turbo-generators and condensing plant should be installed on the electrical side.

And it is my humble opinion that then, and not until then, shall we begin to realise the value of the despised town refuse and stop using coal. At the same time attention will be given, as at Barnes and Dover, to economical scavenging by means of motor lorries, which will bring the refuse from collecting stations to the destructor, for surely, refuse will be worth gathering in from far and near when we know how to use it.

The War Office are just now busy relieving local authorities of their horses, and before such authorities have no horses left they should carefully consider battery refuse vans which will improve their load factor and reduce the cost of scavenging.

The Gas-Filled Lamp in Photography.—In a recent issue the *Electrical World* gave the results of a research by Dr. W. Voege on the effect of operating standard gas-filled lamps at over-voltage, so as to obtain a higher actinic output than is ordinarily available. Starting with an ordinary gas-filled incandescent lamp, normally operated at 12 volts, Dr. Voege operated it at 30 per cent. over-voltage, with the result of bringing down the specific consumption to less than a third of a watt per hefner. The candle-power under this treatment rose 150 per cent., and the actinic power a good deal more, the gain varying according to the character of the photographic paper or plate employed in the test. With a certain paper, for example, the actinic output of the lamp over-run by 30 per cent. increased about 3·75-fold; on a fast dry plate about 2·75-fold. While these figures still leave the incandescent lamp far behind the arc lamp, they show so great an increase over the results at ordinary voltage as to overcome in no small degree the difficulty hitherto felt with respect to the use of this lamp on account of the length of exposure.

Although Dr. Voege's experiments did not include orthochromatic plates, he has done quite enough to show that by raising the voltage on a gas-filled lamp it becomes a most useful auxiliary in photographic working. The subject is worth further investigation. The Electrical Review drew attention to the possibilities of the tungsten lamp in this connection some years ago.

Marylebone.—Coal Contracts.—In October, 1913, the Marylebone Council entered into a contract with Messrs. Cory and Sons for the supply of 20,000 tons of coal. Since the commencement of the war, considerable difficulty has been experienced by the contractors in making delivery in accordance with the contract, and various claims have from time to time been made for extras on the contract. After protracted negotiations the contractors have now agreed to fulfil their obligations.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

9,408. "Cases for ammeters and voltmeters." A. CHINN & H. BUTLER (trading as Central Manufacturing Co.). June 28th.

9,411. "Bell operated electrically." E. KILNER. June 28th.

9,428. "X-ray apparatus." BRITISH THOMSON-HOUSTON CO., LTD. June 28th. (General Electric Co., United States.)

9,442. "Electric induction motors." R. F. M. WOODFORDE. June 28th.

9,447. "Electric hand grenade or shell." W. J. WILSON & W. H. WILSON. June 29th.

9,476. "Wire-working apparatus." BRITISH THOMSON-HOUSTON CO., LTD. June 29th. (General Electric Co., United States.)

9,477. "Means for cooling electrically-operated tools." FRANKFURTER MASCHINENBAU AKT. GES. VORM. POKORNY & WITTEKIND. June 29th. (Convention date June 30th, 1914, Germany.) (Complete.)

9,496. "Telegraphic systems and apparatus." UNITED TELEGRAPH & CABLE CO., and W. M. BRUCE, JUN. June 29th. (Complete.)

9,509. "Electric lamp stands." WALLACE NOVELTY CO. June 29th. (Convention date, July 13th, 1914, United States.) (Complete.)

9,514. "Incandescent electric lamps." J. J. RUSSELL & F. L. HARRISON. June 29th.

9,519. "Magneto ignition devices for internal-combustion engines." A. F. PAYNE. June 30th.

9,522. "Electrical water-heater." J. H. ROBINSON. June 30th.

9,527. "Electric clocks." W. H. SHORTT. June 30th.

9,557. "Dynamo-electric machines." BRITISH THOMSON-HOUSTON CO., LTD. June 30th. (General Electric Co., United States.)

9,573. "Device for recording the position of an engine telegraph at any given time." R. S. O'NEIL. June 30th.

9,582. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD., & P. T. BATES. June 30th.

9,584. "Electric fluid heaters." G. P. ELMEN, S. O. SALISBURY & A. R. TALBOT. June 30th. (Convention date, December 26th, 1914, United States.) (Complete.)

9,627. "Dry batteries." R. DE FORTUNY. July 1st. (Complete.)

9,628. "Electric welding and apparatus therefor." BRITISH THOMSON-HOUSTON CO., LTD. July 1st. (General Electric Co., United States.)

9,635. "Transmission of power to electrically-driven machines." H. S. CASSEL. July 1st. (Complete.)

9,682. "Electrically-operated change-speed gear." OESTERREICHISCHE DAIMLER-MOTOREN AKT. GES. July 2nd. (Convention date, July 14th, 1914, Austria.) (Complete.)

9,684. "Galvanic battery cell of the mercuric-oxide type." J. N. BRONSTED and HELLESENS ENKE & V. LUDVIGSEN. July 2nd. (Complete.)

9,690. "Electron discharge apparatus and method of operating the same." BRITISH THOMSON-HOUSTON CO., LTD. July 2nd. (General Electric Co., United States.)

9,706. "Spring-return mechanism for electric motor controllers and for other purposes." ELECTRIC & ORDNANCE ACCESSORIES CO., LTD., N. G. LANGRISH and L. HODGSON. July 3rd.

9,715. "Magneto-electric machines." S. R. COHEN, B. R. COHEN, & W. TROWELL. July 3rd.

9,720. "Wireless signalling systems." BRITISH THOMSON-HOUSTON CO., LTD. July 3rd. (General Electric Co., United States.)

9,725. "Electrical transmitting apparatus." H. K. HARRIS. July 3rd.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

19,445. HIGH-FREQUENCY ALTERNATING-CURRENT DYNAMOS. M. Breslauer. August 28th.

21,574. MERCURY VAPOUR ELECTRIC RECTIFIERS. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.). September 24th.

21,959. COIL BOBBIN FOR ELECTRIC METERS, MEASURING INSTRUMENTS, OR THE LIKE. Allgemeine Elektricitäts Ges. September 29th. (November 28th, 1912.)

23,336. AUTOMATIC SELECTING DEVICES FOR TELEPHONE SYSTEMS. Siemens and Halske Akt. Ges. October 15th. (October 17th, 1912.)

23,348. ELECTRIC SWITCHGEAR IN WHICH ALL CURRENT-CARRYING PARTS ARE IMMERSED IN OIL OR EMBEDDED IN AN INSULATED MASS. Allgemeine Elektricitäts Ges. October 15th. (October 15th, 1912.)

1914.

6,992. ELECTRIC IGNITION SYSTEMS FOR INTERNAL-COMBUSTION ENGINES. O. Heins & C. M. Wild. March 19th. (March 19th, 1913.)

7,007. REGULATORS FOR ELECTRIC CIRCUITS. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.). March 19th.

7,200. TELEGRAPH OR TELEPHONE RELAY. C. Still. March 21st.

7,202. METHOD OF TRANSMITTING SOUNDS ELECTRICALLY. C. Still. March 21st.

7,203. MICROPHONES. C. Still. March 21st.

7,208. NUMBER INSTRUMENTS FOR AUTOMATIC TELEPHONE SYSTEMS. Siemens Bros. & Co. and E. A. Petithory. March 21st. (Addition to 14,614/13.)

7,266. ELECTRICAL BURGLAR ALARMS. A. Zehden. March 23rd. (March 25th, 1913.)

7,327. APPARATUS FOR SUPERVISING TELEPHONE EXCHANGES WORKING ON A SEMI-AUTOMATIC SYSTEM. Siemens & Halske Akt. Ges. March 23rd. (March 25th, 1913.)

11,708. ARRANGEMENTS FOR WIRELESS TELEGRAPHY AND TELEPHONY. J. Schiessler. May 12th. (October 16th, 1913. Divided application on 29,447/13, December 29th.)

14,021. ELECTRICALLY-DRIVEN DRILLING MACHINE. Siemens Shuckert-Werke Ges. June 10th. (June 13th, 1913.)

14,163. APPLIANCES FOR MAINTAINING ELECTRIC CONDUCTIVITY CONDUIT SYSTEMS FOR CARRYING CABLES FOR POWER, LIGHT, OR OTHER ELECTRICAL INSTALLATIONS. F. J. B. Wineberg & E. T. Parker. June 12th.

14,392. FITTINGS FOR METALLIC CONDUIT SYSTEMS OF ELECTRICAL WIRING. T. Manson. June 15th.

14,469. ELECTRICAL HEATING APPARATUS. A. F. Berry. June 16th.

14,739. APPARATUS FOR DISINFECTING THE MOUTHPIECES OF TELEPHONE TRANSMITTERS. H. H. Mahieu. June 19th.

14,808. TELEPHONE SYSTEMS. R. H. Burfeind. June 19th. (June 21st, 1913.)

15,068. NOZZLE PLUGS FOR FLUID FLOW METERS. British Thomson-Houston Co. (General Electric Co.). June 23rd.

15,125. TELEPHONE SWITCHES. T. Green. June 24th.

16,984. ELECTRIC CIRCUIT BREAKERS. C. Ellison. July 17th.

19,538. ELECTROPHONES. E. W. Schneider & E. H. Stolz. September 8th.

19,679. ELECTRIC HAND LAMP. T. E. Dickinson & Optalyte, Ltd. September 11th.

19,908. ELECTRICAL CONDUIT FITTINGS. J. R. A. Hemming & A. E. Beck. Sept. 18th.

19,943. ELECTRIC RHEOSTATS. British Thomson-Houston Co. (General Electric Co.). September 18th.

20,129. ELECTRIC RHEOSTATS. British Thomson-Houston Co. (General Electric Co.). September 24th.

20,342. SYSTEM OF AND MEANS FOR SIGNALLING ELECTRICALLY, ESPECIALLY FOR USE IN COAL MINES AND THE LIKE. H. Green & W. de M. Landon. September 30th.

20,927. ELECTRO-MAGNETIC SWITCH. Robert Bosch (firm of). October 13th. (June 8th, 1914.)

21,782. ELECTRIC STARTERS FOR USE ON MOTOR-CARS AND THE LIKE. A. H. Midgley & C. A. Vandervell. October 20th.

22,044. DASH POT PLUNGERS. Electric & Ordnance Accessories Co., Ltd., and J. Etchells. November 5th.

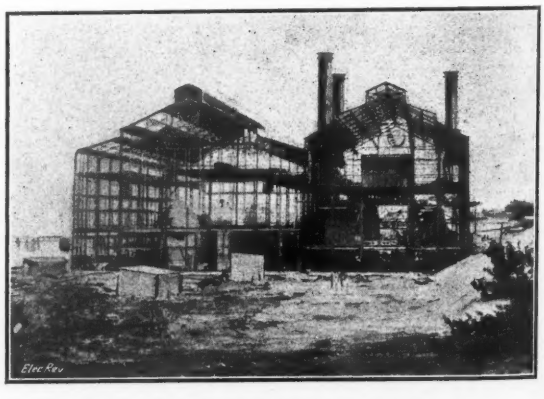
24,742. FITTINGS FOR CONDUITS FOR ELECTRICAL CONDUCTORS. A. W. Sclater. December 29th.

1915.

1,530. ELECTRIC BATTERIES. B. Pordes. January 30th.

4,560. DYNAMO-ELECTRIC MACHINES. British Westinghouse Electric and Manufacturing Co. March 23rd. (March 23rd, 1914.)

West Australian Government Power Station.—The accompanying illustration shows the new power station near Perth, W.A., which is being erected by the Government of Western Australia to supply the Government tramways, and to provide a bulk supply for the city of Perth and the surrounding towns and



POWER STATION IN COURSE OF ERECTION.

districts within a radius of 15 miles. The station will have a plant capacity of 12,000 KW., and will work at 6,000 and 20,000 volts, three-phase, 40 cycles. The city supply will be given through a ring main at 6,000 volts. We are indebted for the photograph to Mr. W. H. Taylor, formerly assistant engineer at Walthamstow, who went out in January last year to take the post of electrical superintendent of the Government tramways and power supply.

Workmen's Compensation.—It is common knowledge that in the negotiations which take place respecting compensation to workers who may have been injured in the course of their employment, the parties most intimately concerned are not the employer, and the injured person, but the insurance company and the worker. Judge Mellor, who has naturally a wide knowledge of workmen's compensation cases, and can speak with authority on things as he finds them in the Manchester County Court, declared there on Thursday of last week that his experience was that in only two per cent. of cases under the Workmen's Compensation Act were the employers directly interested. The disputes were usually between the workmen and the insurance companies, and about 50 per cent. of the workmen, being members of Trade Unions, had their interests properly safeguarded, while the other 50 per cent. (including women and children) were not in the ranks of organised labour, and were likely to stand in a very bad way unless County Court Judges looked after them. He had consulted with other judges, and had come to the conclusion that in cases of injuries to workmen declarations of liability were about the most valuable means of protecting workmen against insurance companies who tried various dodges "in order to avoid their liabilities."